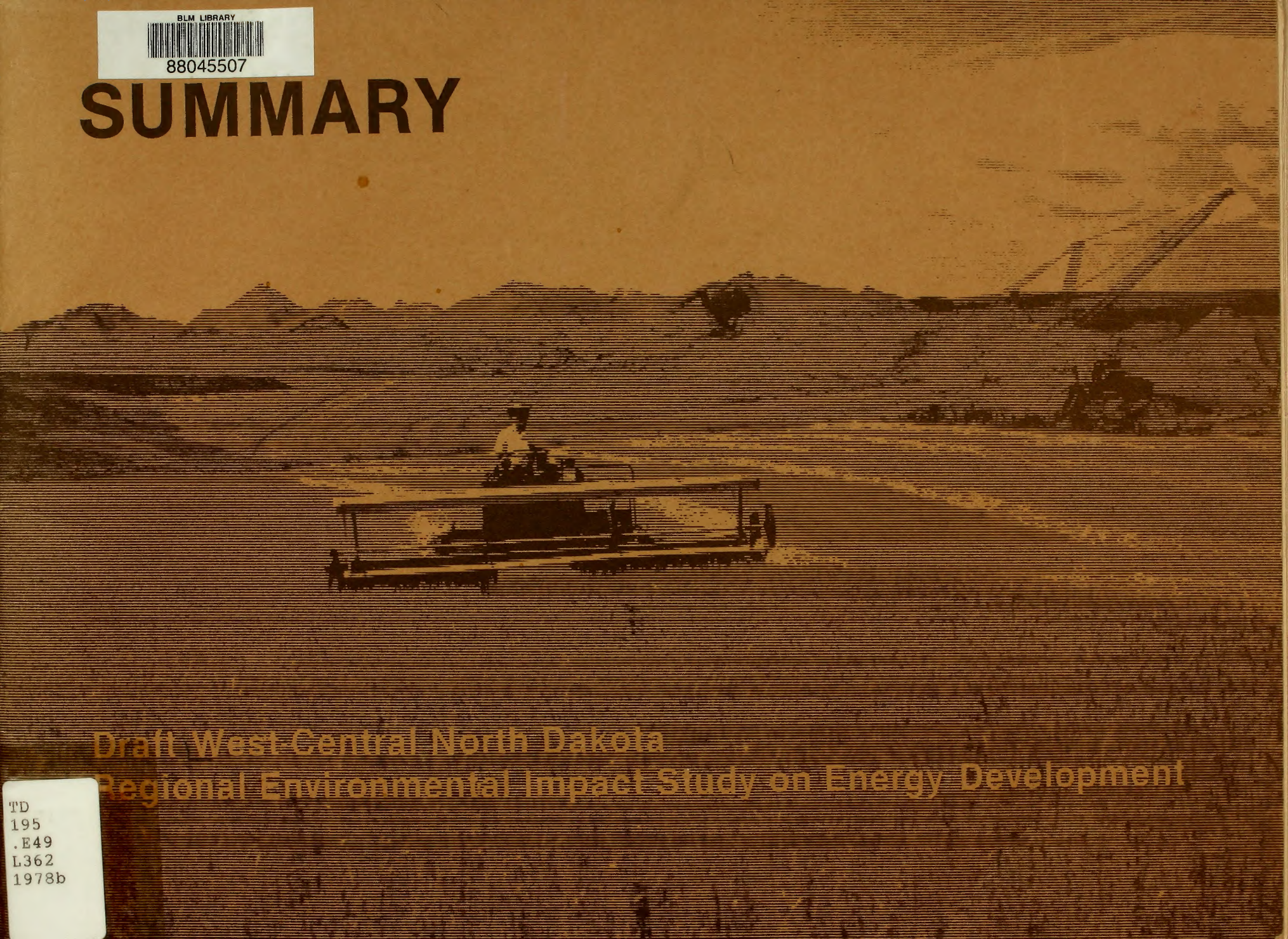


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SUMMARY



Draft West-Central North Dakota
Regional Environmental Impact Study on Energy Development

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Notice
(Attach to Draft Study)

This Draft Study should be used simultaneously with the Final West-Central North Dakota Environmental Impact Study on Energy Development, released in February 1979. In addition to public comments and minor changes, the Final Study supplements the Draft Study with new information and revisions especially affecting the following areas:

PROPOSED ACTION

- Federal Coal Management Program
- Surface Owner Protection
- Status of Permits and Approvals on Energy Conversion Facilities
- Oil Production in Dunn and Stark Counties

CLIMATE AND AIR QUALITY

- Clean Air Act Amendments of 1977
- Effects of Oil and Gas Production on Air Quality
- Air Pollution Effects to Human Health, Animals, Vegetation, and Man-made Materials
- Radiation Effects
- Acid Rainfall Effects

GEOLOGY

- Oil and Gas Development
- Resolution on Conflicts Between Coal Development and other Mineral Development

SOILS

- Prime Farmland
- Sodium Hazard
- Reclamation Costs

WATER

- Federal Water Pollution Control Act
- Air Emissions and Mining Effects on Water Quality

VEGETATION

- Reclamation
- Productivity

ANIMALS

- Effects of Post-Mining Land Use Decisions on Wildlife
- Effects of Transmission Lines on Raptors
- Prairie Dogs/Black-Footed Ferrets
- Northern Kit Fox
- Whooping Crane Critical Habitat

PREHISTORIC AND HISTORIC FEATURES

- Additional Inventory Data

RECREATION

- Fort Berthold Reservation Jurisdictional Issues

ECONOMIC CONDITIONS

- Effects of Oil and Gas Development on Dickinson and Killdeer
- North Dakota Regional Environmental Assessment Program (REAP) Model

SOCIAL CONDITIONS

- Social Environmental and Human Pathology
- Social-Demographic Effects
- Mental Health Effects

LAND USE

- Dunn County Zoning Ordinance and Comprehensive Land Use Plan
- Level 1 and 2 Surface Disturbance
- Surface Owner Rights
- Transmission Line Lengths
- Fort Berthold Reservation Jurisdictional Issues
- Effects of Coal Train Traffic Passing Through Seven-County Study Area

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SUMMARY

Draft West-Central North Dakota Regional Environmental Impact Study on Energy Development

Material contained in this summary was extracted from the environmental impact study prepared jointly by the U.S. Department of the Interior, Bureau of Land Management and the State of North Dakota.

March, 1978



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Signing of the Memorandum of Understanding by Governor Arthur A. Link and Edwin Zaldicz, BLM State Director, in January 1975.

Introduction

This document summarizes the West-Central North Dakota Regional Environmental Impact Study on Energy Development, an assessment of the cumulative impacts of proposed coal and energy related development in west-central North Dakota. The seven county study area comprises 11,213 square miles and includes all of Burleigh, Dunn, McLean, Mercer, Morton, Oliver, and Stark Counties. These counties encompass that portion of North Dakota having a high potential for energy development due primarily to coal and water resource availability. Critical decisions face or will likely face federal, state, and local public agencies regarding energy industry proposals and government coal resource planning. The study is part of efforts by the state and federal governments to coordinate planning activities in this area.

This joint federal-state study evolved from a 1975 Memorandum of Understanding between the Department of Interior's Bureau of Land Management and the State of North Dakota. In the Memorandum, both parties agreed that:

"It is in their mutual interest to enter into a coordinated approach for the development and implementation of land use studies and, where possible, the implementation of coordinated management plans and programs within the boundaries of the state of North Dakota. . . ."

Full state participation was made possible through grants from the Old West Regional Commission.

The primary intent of this study was to address the cumulative impacts of proposed and potential coal development in this area in order that state, federal, and local governments might develop prudent policy decisions. The joint federal-state effort was deemed neces-

sary because of the presence of complex land ownership patterns that restrict any single entity from making unilateral planning decisions.

Another intent of the study was to comply with the National Environmental Policy Act of 1969 (NEPA) requirements, prior to the authorization of any new federal coal leasing and other activities in North Dakota. As a result of litigation involving federal coal policy, the effort was changed into a study focusing on the primary intent of aiding future government planning activities. Although no longer the formal document required by NEPA to be submitted to the Environmental Protection Agency, the format, content, and analysis are the same as that required by NEPA.

In the instance of federal coal, no proposed leasing actions exist or are evaluated in the study. The Federal Coal Study Areas identified as having future development potential are evaluated in a regional context in order to provide information for more detailed coal resource planning. Firm actions and permit applications are pending before state and other federal agencies.

Selection of the seven counties was based upon the identification of industry proposals, the location of resultant social and economic impacts, and coal leasing interest expressed by industry in 1976. Although the seven counties constitute the principal study area, impacts extending beyond the area were also examined. Impacts affecting the Fort Berthold Reservation, sections of which are part of the seven county study area, have also been addressed. A federal-state intergovernmental group was designated to review the document prior to issuance.

The nine work groups responsible for the various environmental components included representatives of 17 federal and 32 state agencies. These work groups prepared their analyses according to the following guide-

lines set forth in NEPA:

- Describe the proposed or potential future actions.
- Describe the existing environment.
- Assess the environmental impacts of the proposed action.
- Identify measures for mitigating adverse impacts.
- Determine residual adverse impacts still remaining after mitigation.
- Describe the relationship between the short-term use and long-term productivity of the environment.
- Identify irreversible and irretrievable resource commitments.
- Examine alternatives to the proposed and possible future actions.

The State of North Dakota and the Bureau of Land Management are committed to addressing citizen concerns. Meetings with industry representatives were held to identify projects to be included in the proposed action. Initial citizen participation was encouraged with seven public meetings held to gather and document those concerns. The study has been extensively publicized, and public comment has been, and will continue to be, solicited. Public meetings will be held again after completion of the study.

This summary describes the proposed action and possible alternatives, and highlights the analysis by environmental component. Readers desiring detailed information are urged to refer to the complete Regional Environmental Impact Study document, the accompanying site-specific analyses and the technical supplements.

Proposed Action

The proposed and possible future actions were organized into three levels of development and 12 Federal Coal Study Areas. Projects in Level 1 and Level 2 development are site-specific and are examined individually and cumulatively. Level 3 focuses on less specific, potential coal development. The proposed development is analyzed in relation to existing energy projects. Map 1 presents those facilities and mines considered part of the baseline environment.

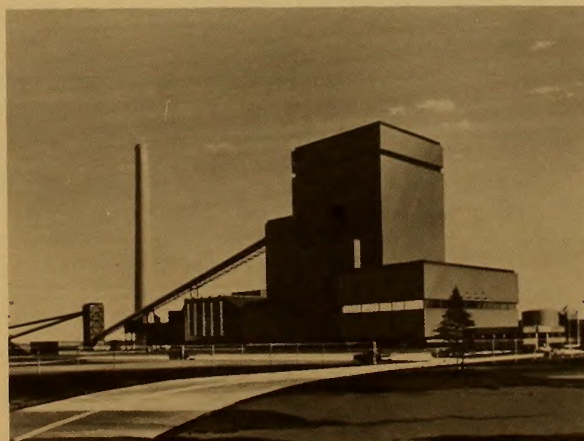
LEVEL 1

Level 1 development consists of five *active* proposals, including mines, generating stations, and gasification facilities, expected to be initiated within the next few years (Map 2). These projects are analyzed according to the cumulative regional environmental consequences should all of these projects be approved. Projects are addressed individually where certain unique features warrant attention. Each of the projects in Level 1 are summarized in Table 1 and are also addressed in separate site-specific environmental impact statements. Level 1 includes the following:

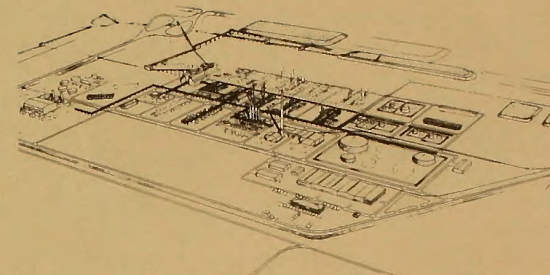
Coyote 1 Power Plant and South Beulah Mine

Montana-Dakota Utilities Company's 440 megawatt Coyote 1 Power Plant would be built four miles southwest of Beulah. The plant would use 2.2 million tons of coal annually, to be mined at the existing South Beulah Mine

operated by Knife River Coal Mining Company, a subsidiary of Montana-Dakota Utilities Company. The project would require dual 345 kilovolt (kv) lines between the site and Minnkota's Milton R. Young Plant near Center, North Dakota, and upgrading of a 230 kv line, presently extending from Center to Fargo, North Dakota, to 345 kv. The new plant would use 11,000 acre-feet of water annually, transported via a 21-mile pipeline from an intake located on the Missouri River near Stanton, North Dakota. The plant, which would employ 70 permanent workers, would accommodate anticipated demand growth in the North Dakota-Minnesota area. Completion is scheduled by 1981.



Coyote 1 Power Plant



ANG Coal Gasification Plant

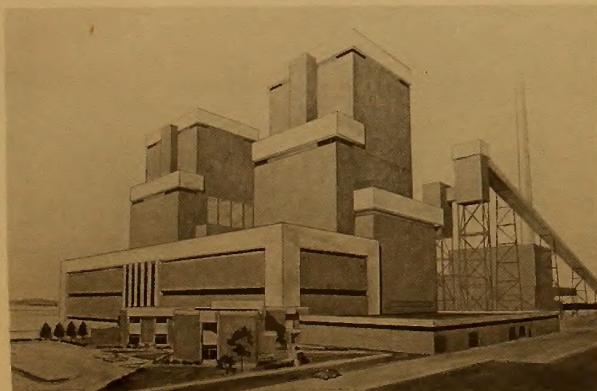
ANG Coal Gasification Plant and Coteau Mine

ANG Coal Gasification Company's synthetic natural gas plant would be located seven miles north, northwest of Beulah. The plant would be constructed in two phases and would produce 275 million standard cubic feet of gas per day. Natural Gas Pipeline Company of America (NGPL) would be co-owner of the first phase. The 9.4 million tons of coal used each year would be obtained from a new 14.6 million ton per year mine operated by Coteau Properties Incorporated, a subsidiary of North American Coal Corporation. An eight-mile pipeline would carry approximately 17,000 acre-feet of water annually from Lake Sakakawea to the ANG site and a 365-mile pipeline would be constructed to transport the synthetic natural gas to an existing pipeline near Thief River Falls, Minnesota. First phase gas

production would be equally shared by ANG and NGPL parent firms (American Natural Resources, Detroit, and Peoples Gas Company, Chicago), with a similar arrangement expected for second phase gas production. Construction on the first phase would begin in 1978 and end in 1982. The plant would be operable for one year prior to initiation of second phase construction. Permanent employment would total 640 workers at the plant and 514 at the mine.

Antelope Valley Power Plant and Coteau Mine

The Antelope Valley Power Plant, proposed by Basin Electric Power Cooperative, would be built adjacent to the ANG Coal Gasification Plant. The two 438 megawatt units would consume 5.2 million tons of coal per year from the Coteau Mine. Electricity would be transmitted via two new 345 kv lines to Basin's Leland Olds Power Plant near Stanton, North Dakota, and a new 500 kv line to Huron, South Dakota. The Antelope Valley Power Plant would utilize the same pipeline as ANG for its annual water requirement of 11,400 acre-feet. Basin is committed to supplying 160 megawatts of power to the ANG Coal Gasification Plant with the remainder allocated to Basin's member system



Antelope Valley Power Plant

TABLE 1
LEVEL 1 AND 2 SUMMARY

Project	County Location	Plant Capacity	Lignite Mined Million Tons Per Year	Acres Mined Annual	Acres Mined Total	Water Use Acre Ft./Yr.	Peak Construction Year	Workforce Number
Coyote 1 Power Plant	Mercer	440 MW ¹	—	—	—	11,000	1980	930
South Beulah Mine	Mercer/Oliver	—	2.2	70	2,100	—	1980	70
ANG Coal Gasification Plant	Mercer	275 MMSCFD ²	—	—	—	17,000	1980	1,929
Coteau Mine	Mercer	—	9.4	500	17,979	848	1979	320
Antelope Valley Power Plant	Mercer	876 MW	—	—	—	11,400	1980	832
Coteau Mine	Mercer	—	5.2	(. See figures under ANG above)				
NGPL Coal Gasification Plant	Dunn	275 MMSCFD	—	—	—	11,750	1982	3,900
AMAX Mine	Dunn	—	13.9	350	10,200	350	1983	188
Glenharold Mine	Mercer/Oliver	—	3.8	155	3,938	38	—	—
LEVEL 1 TOTAL		<u>550 MMSCFD</u> 1,316 MW	34.5	1,075	34,217	52,022	1981 ³	5,626
Dakota Star Mine	Mercer	—	4.0	301	10,600	22	1985	75
Nokota Mine	McLean	—	6.6	340	11,900	76	1982	125
Renner's Cove Mine	Mercer	—	3.0	120	2,400	37	1985	65
Underwood Mine	McLean	—	1.5	120	2,400	25	1985	45
Washburn Mine	McLean	—	5.0	442	12,400	40	1985	90
Coyote 2 Power Plant	Mercer	440 MW	—	—	—	10,000	1984	837
South Beulah Mine	Mercer/Oliver	—	2.2	70	2,100	—	—	—
Tentative Project Total		440 MW	22.3	1,393	41,800	10,200	1984	962
LEVEL 2 TOTAL		<u>550 MMSCFD</u> 1,756 MW	56.8	2,468	76,017	62,222	1983 ³	6,367

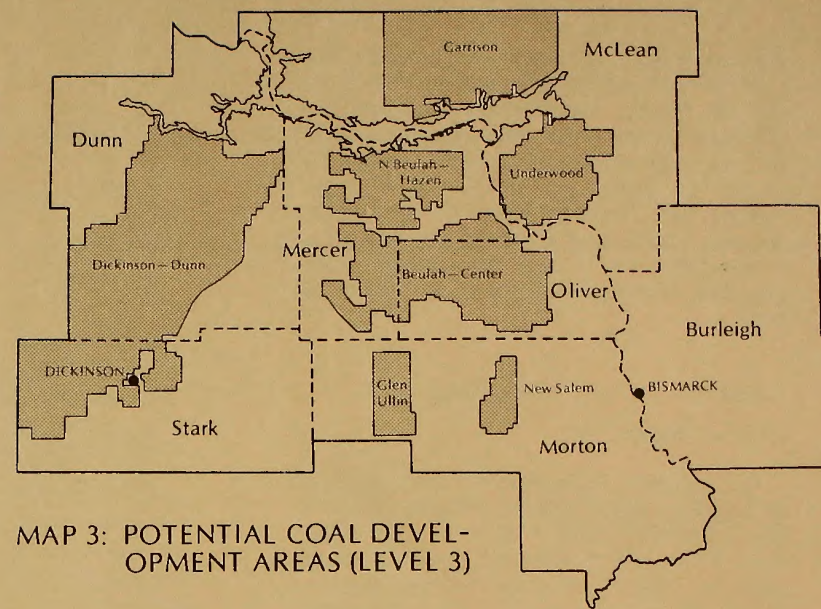
¹ MW = Megawatts

² MMSCFD = Million standard cubic feet per day

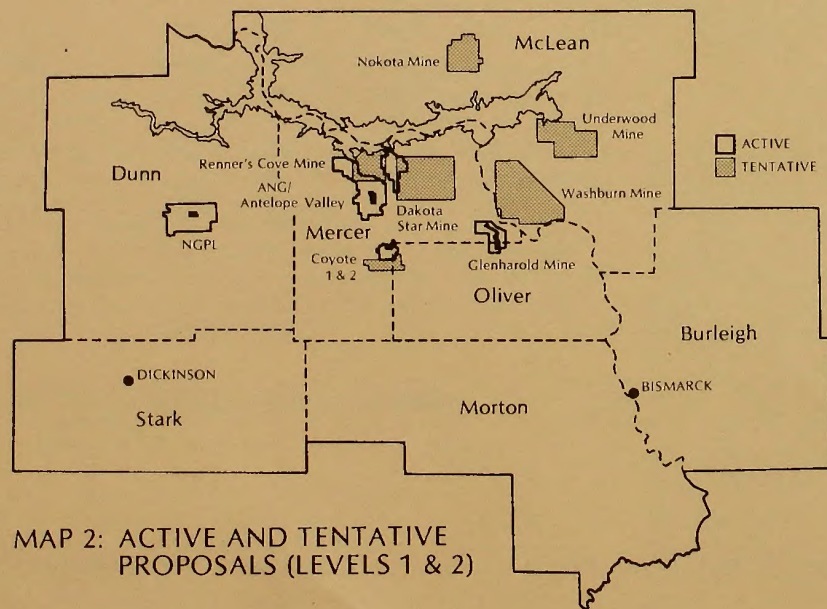
³ In selecting this year, consideration was not given to 1,680 ANG pipeline construction workers to be employed in 1980.



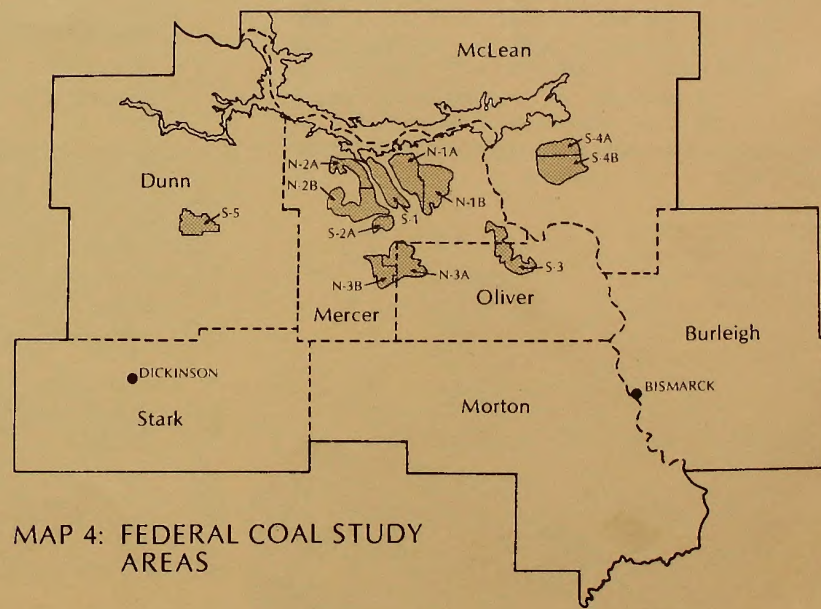
MAP 1: EXISTING ENERGY FACILITIES AND MINES



MAP 3: POTENTIAL COAL DEVELOPMENT AREAS (LEVEL 3)



MAP 2: ACTIVE AND TENTATIVE PROPOSALS (LEVELS 1 & 2)

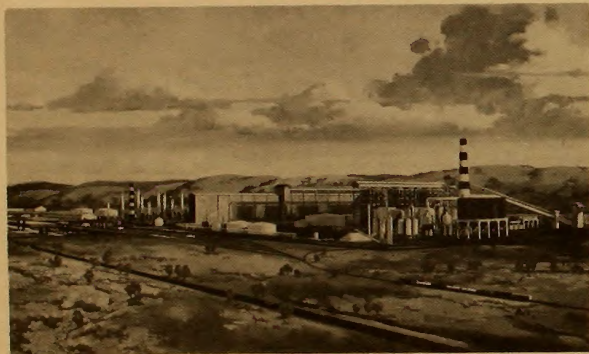


MAP 4: FEDERAL COAL STUDY AREAS

in the Dakotas, Minnesota, Iowa, Nebraska, and Montana. Construction would begin in 1978 and both units would be operable by 1983. The Antelope Valley Power Plant would have 160 permanent employees.

NGPL Coal Gasification Plant and AMAX Mine

Natural Gas Pipeline Company of America's proposed 275 million standard cubic feet per day synthetic natural gas plant would be located five miles southwest of Dunn Center, North Dakota. A new AMAX Coal Company mine would supply the plant with 13.9 million tons of coal annually. The project would withdraw 11,750 acre-feet of water per year from Lake Sakakawea via a 24-mile pipeline. The proposed Northern Border pipeline, expected to pass near the plant site, would carry the synthetic natural gas primarily to the Chicago area customers of Peoples Gas Company. NGPL would start construction in 1980 with completion expected by 1984. The plant would permanently employ 612 people and the AMAX Mine would employ an additional 474 workers.

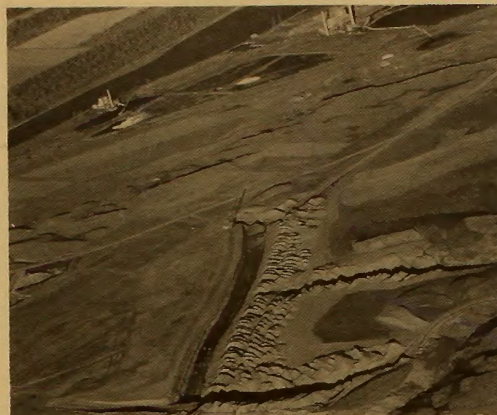


NGPL Coal Gasification Plant

Glenharold Mine

Consolidation Coal Company proposes to continue operation of its existing 3.8 million

ton per year Glenharold Mine through acquisition of additional federal coal leases and state mining permits. Nearly all the coal produced at the mine is committed to Basin's Leland Olds Power Plant, which supplies electricity to the Basin system in the Dakotas, Minnesota, Iowa, Nebraska, and Montana. The Glenharold Mine employed 156 workers in 1977.



Glenharold Mine

The four mines included in Level 1 would produce a lignite coal with an average heating value of approximately 6,660 Btu's. The coal would be surface mined beginning with topsoil removal, followed by overburden removal, extraction of the coal, and reclamation of the mined area. The Level 1 mining of 34.5 million tons per year would increase the 1976 seven county study area coal production by 450%. The area disturbed by the mines would total about 34,217 acres over the project lifetimes. Between 4,300 to 6,450 acres would be disturbed at any one time.

The Lurgi coal gasification process, to be used by both ANG and NGPL, produces a crude gas when coal, steam, and oxygen react under controlled temperature and pressure. The gas is cooled and purified before compression and delivery to the pipeline. Large coal and chemical storage areas would be necessary and waste systems would be required for the disposal of gaseous, liquid, and solid materials. The two gasification plants would produce approximately 183 billion cubic feet of gas annually, 250 times the forecasted

North Dakota need by 1985 but less than 1% of the forecasted U.S. need by that date. Total yearly lignite requirements for the two plants would amount to 23.3 million tons.

Both the Coyote 1 and Antelope Valley Power Plants would be mine mouth facilities with a combined capacity of 1,316 megawatts. About 7.4 million tons of coal per year would be needed to fuel their combustion cycles. Combustion heat is used to produce steam, which is conveyed from the boilers to the superheaters. The superheated steam is then transferred to turbines where a generator converts it to electrical energy. Gaseous, liquid, and solid waste disposal systems would be necessary. Of the 968 megawatts of net power produced, 350 megawatts, or 36%, is forecasted for use within North Dakota.

Most of the transmission and pipeline rights-of-way would cross private property, requiring easement acquisition. Although counties have some control over siting through their zoning power, the North Dakota Public Service Commission exercises final jurisdiction over proposed routes. Reclamation would restore land temporarily disturbed during construction. New road and railroad facilities would also be needed to move materials and personnel to and from the project sites.

LEVEL 2

Level 2 development analyzes six tentative proposals anticipated to be started between 1985 and 1990 (Table 1), and also accumulates the effects of active proposals from Level 1. None of the tentative proposals shown on Map 2 have government permit applications pending and any federal, state, or local action would require further site-specific environmental study.

The tentative projects include the following:

Dakota Star Mine

The Dakota Star Mine would be located five miles north of Hazen and would be operated by Consolidation Coal Company. The mine would produce four million tons of coal per year and would have 176 permanent employees.

Nokota Mine

The Nokota Mine would be operated by the Nokota Company. Located three miles north of Garrison, it would be built in two phases and produce about 6.6 million tons of coal annually. The mine would employ 225 workers.

Renner's Cove Mine

Also operated by Consolidation Coal Company, the Renner's Cove Mine would produce about three million tons of coal per year. The proposed site is 11 miles north of Beulah. The mine would have 120 permanent employees.

Underwood Mine

The Underwood Mine, located one mile northeast of Underwood, would produce about 1.5 million tons of coal annually. The mine would be operated by Consolidation Coal Company and would require 50 permanent employees.

Washburn Mine

The Washburn Mine, operated by Consolidation Coal Company, would produce five million tons of coal per year. The proposed site is about six miles southwest of Underwood. The mine would have 202 permanent employees.

Coyote 2 Power Plant and South Beulah Mine

Montana-Dakota Utilities Company's 440 megawatt Coyote 2 Power Plant would be built adjacent to the Coyote 1 Power Plant four miles southwest of Beulah. The plant would consume 2.2 million tons of coal annually, obtained from the South Beulah Mine, and would utilize 10,000 acre-feet of Missouri River water per year. The project would require 40 new plant employees and 15 new mine employees.

Mining procedures would be similar to those described for Level 1. Tentative proposals would increase lignite production by 22.3 million tons per year, resulting in a total Level 2 production of 56.8 million tons. This would increase the seven county production by slightly more than 700%.

Level 2 electric generating capacity with the Coyote 2 Power Plant would total 1,756 megawatts.

LEVEL 3

Level 3 development includes no specific project proposals, but instead evaluates broad physical and biological impacts which could result from unspecified potential energy development in Level 3 areas after 1990. These areas, as shown on Map 3, were delineated on the basis of geological information concerning known coal resources, leasing interest expressed through the Department of the Interior's coal nomination procedure, and letters of intent from the energy industry. It is estimated that 4 to 5 billion tons of potential stripping coal lies under Level 3 areas. The analysis concentrates primarily on fragile topography, critical habitat, and rare and endangered species, and is more qualitative than quantitative.

FEDERAL COAL STUDY AREAS

There are no federal leasing proposals in this study. However, 12 Federal Coal Study Areas—tracts having potential for future development of federal coal—are evaluated in the study as a part of the Bureau of Land Management's overall resource planning process.

The areas, developed by the Bureau of Land Management's Dickinson District Office, contain 121,879 acres and an estimated 2.5 billion tons of strippable coal. In addition to federal coal, these areas include a random distribution of state and privately owned coal. Although the Federal Coal Study Areas are located near existing or proposed energy development, any potential federal leasing would be competitive, allowing bids from any interested parties. Should future leasing occur, according to present preliminary land use plans areas labeled "S" on Map 4 would be considered for

development first, while those labeled "N" would be considered for development prior to 1990. With the exception of the NGPL Coal Gasification Plant and Glenharold Mine projects, all industry proposals are capable of operation without additional federal coal. However, federal coal would increase mine efficiency and lessen the potential for loss of the coal resource. In any case, these areas are subject to reevaluation prior to any final federal coal development decisions, based both upon this study and the results of the programmatic environmental impact statement on federal coal leasing nationally.

GOVERNMENTAL AUTHORITIES

The proposed action would require a variety of permits and compliance with laws, regulations, and procedures at many levels of government. The projects would be subject to federal and state mining and reclamation laws, water allocation and diversion laws, air and water quality standards, state energy conversion facility and transmission law siting regulations, and county and municipal zoning authorities.

OTHER ENERGY ACTIVITY

A number of other specific energy related developments could affect the seven county study area. These include the proposed Northern Border Gas Pipeline, Northern Tier Oil Pipeline, and Garrison Dam Hydroelectric Station expansion; new oil discoveries in Dunn County; and an air quality designation petition which could limit new development by establishing more restrictive standards in Dunn County.



Climate and Air Quality

The climate of the seven county study area is generally characterized by light to moderate precipitation, irregular in time and area of coverage; low relative humidity; and nearly continuous air movement with prevailing northwesterly surface winds. Average precipitation totals between 16 and 18 inches per year. The mean annual temperature ranges from 38 to 42 degrees Fahrenheit.

Principal air contaminants identifiable in the seven county study area include particulates, sulfur dioxide, and oxides of nitrogen. These contaminants can be attributed to area sources, such as unpaved roads, agricultural field operations, open burning, vehicle exhausts, and mining activity; and to point sources, such as existing power plants and refineries. Area sources are responsible for most of the particulate concentrations, and point sources account for nearly all of the sulfur dioxides and oxides of nitrogen concentrations.

Very little information exists concerning present amounts of trace elements contributed by various sources to the ambient air. Present concentrations of carbon monoxide and hydrogen sulfide are below detectable limits. Existing levels of photochemical oxidants are primarily due to natural sources.

The federal Environmental Protection Agency and the North Dakota State Department of Health have established a regulatory framework which limits the deterioration of air quality. The seven county study area has been categorized as Class II, thus defining and allowing deterioration which would accompany moderate, well-controlled industrial growth.

None of the existing sources of air contaminants in the seven counties is expected to violate any federal or state air quality standards and regulations.

MAJOR IMPACTS

Removing and stockpiling of topsoil during Level 1 and 2 construction and mining would destroy vegetative cover, increase surface temperatures, and modify the direction and flow of surface air. It is expected that the microclimates in the immediate project areas would be affected, although the magnitude of the temperature, wind, or moisture modifications would not impact larger

scales of weather.

Existing and new area sources, such as unpaved roads, agricultural activities, and mining operations, would constitute the major particulate emissions occurring during Level 1 and 2 development. Point source power and gasification plants would account for 65% of new Level 1 emissions and 55% of new Level 2 particulate emissions. The other emissions for each level would be attributable to proposed mining activity, as shown in Figure 1. Projected annual concentrations of

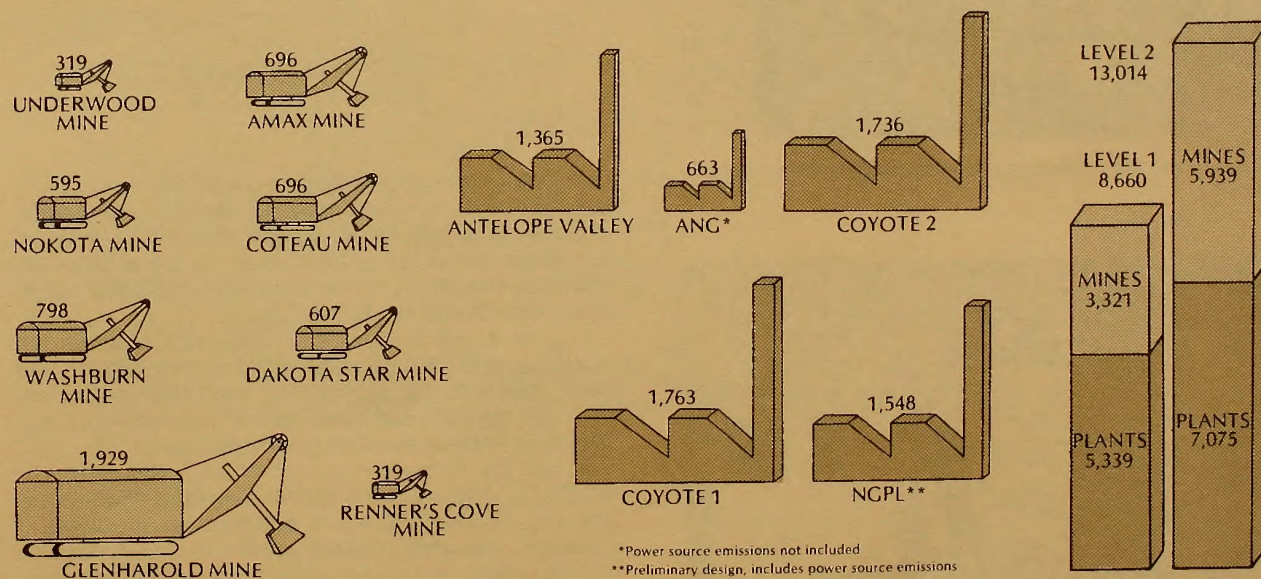


FIGURE 1: EXPECTED PARTICULATE EMISSIONS (tons per year)

particulates in the air would be at a maximum near Zap in Mercer County. Mining operations, including those which could occur in Federal Coal Study Areas, tend to have high particulate concentrations within the immediate mine area. Concentrations from industrial sources within their property boundaries are not subject to federal and state air quality regulations.

Nearly all of the projected sulfur dioxide concentrations would result from point source power and gasification plant operations. Figure 2 shows expected sulfur dioxide emissions by project and level. The location of maximum annual concentration is expected to occur in the area immediately south of the ANG Coal Gasification Plant site as a result of the accumulation of sulfur dioxide emissions from existing and proposed point sources.



State Health Department instruments record air contaminant levels.



A typical State Health Department air monitoring station.

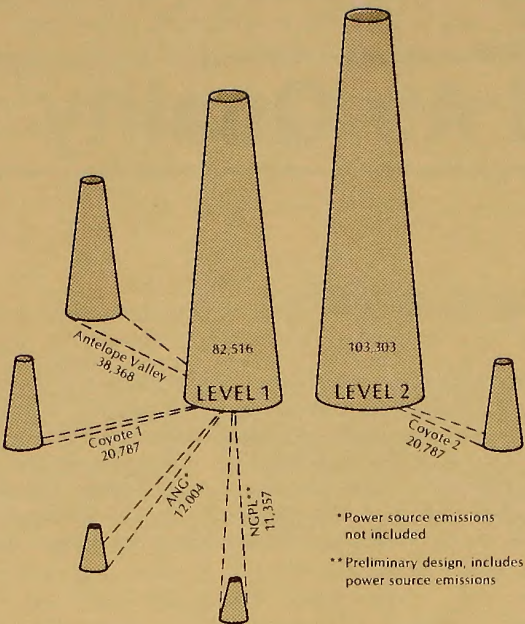


FIGURE 2: EXPECTED SULFUR DIOXIDE EMISSIONS (tons per year)

Oxides of nitrogen emissions are shown in Figure 3. New oxides of nitrogen emissions would be attributable primarily to project point sources. Area sources would contribute only small concentrations to the ambient air. Predicted maximum ground level concentrations would occur near Beulah in Mercer County.

Figures 4 and 5 depict the relationship between the major air contaminants, background, and federal and state standards for annual and short-term concentrations. Background indicates the existing amount of contaminants without new energy development.

Under the Prevention of Significant Deterioration of Air Quality Regulations, a specified amount of deterioration is permitted. Figures 4 and 5 show the Class II maximum allowable increase above background for particulate matter and sulfur dioxide, the increments used by both Level 1 and 2 development, and the maximum allowable limits under state Ambient Air Quality regula-

tions. Predicted Level 2 one-hour nitrogen dioxide concentrations would exceed the maximum numerical ambient air quality value. Ambient air quality standards allow this situation to occur, provided that value is not exceeded more than 1% of the time during any three month period. This situation is expected to occur less than .001% of the time.

Trace element impacts have not been totally defined, particularly over extended periods of time. Available data indicates, however, that the probability of short-term adverse impacts is low.

Increases in carbon monoxide and hydrocarbon concentrations would be expected, particularly during project construction, due to additional vehicle traffic and heavy construction equipment operation. These concentrations are not expected to exceed permissible standards. Photochemical oxidants would also increase; however, the increase would be small compared to the existing background of naturally occurring photochemical oxidants which may already exceed federal and state Ambient Air Quality Standards.

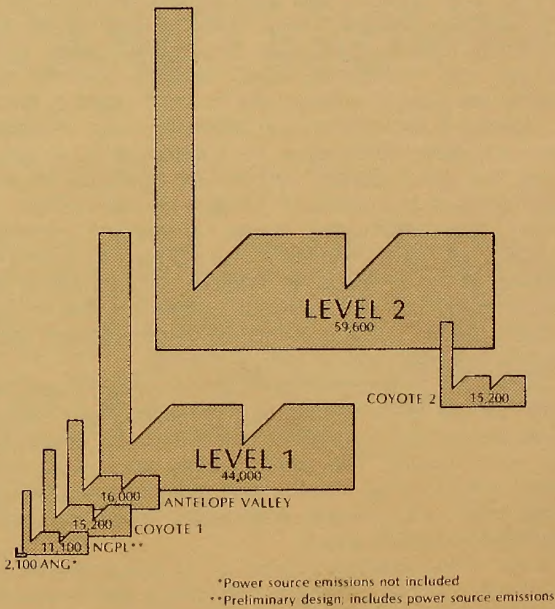
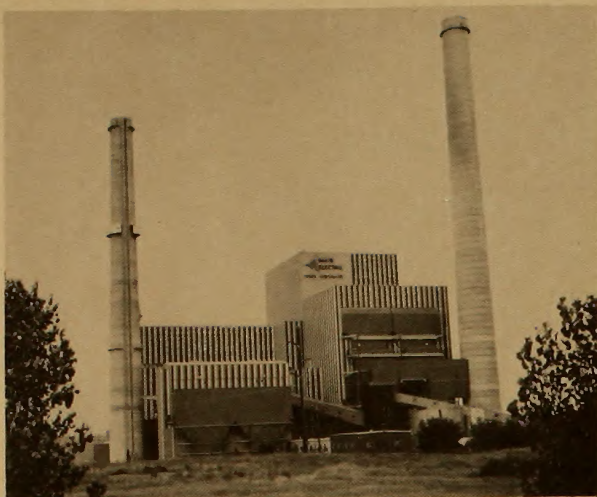


FIGURE 3: EXPECTED NITROGEN DIOXIDE EMISSIONS (tons per year)



The dark grey electrostatic precipitators at this plant control particulate emissions.

Predicted contaminant concentrations over the Fort Berthold Reservation from the proposed projects would comply with all federal standards.

Future Level 3 energy development would depend on the remaining increment of particulate matter and sulfur dioxide contaminants allowable under regulations governing the prevention of significant deterioration of air quality. Non-energy growth would also compete for this remaining increment. Site-specific analysis of each future emission source would be necessary in order to determine whether the remaining increment would be exceeded. These analyses would consider contaminant dispersion and the resultant interaction with other sources.

MITIGATING MEASURES

Concentrations of particulate matter associated with plant construction and mining would be reduced by minimizing the exposed surface area, orienting topsoil stockpiles to retard wind erosion, quickly restoring vegetative cover to reclaimed areas and topsoil stockpiles, and sprinkling or oiling haul roads.

All of the power plant and gasification plant appli-

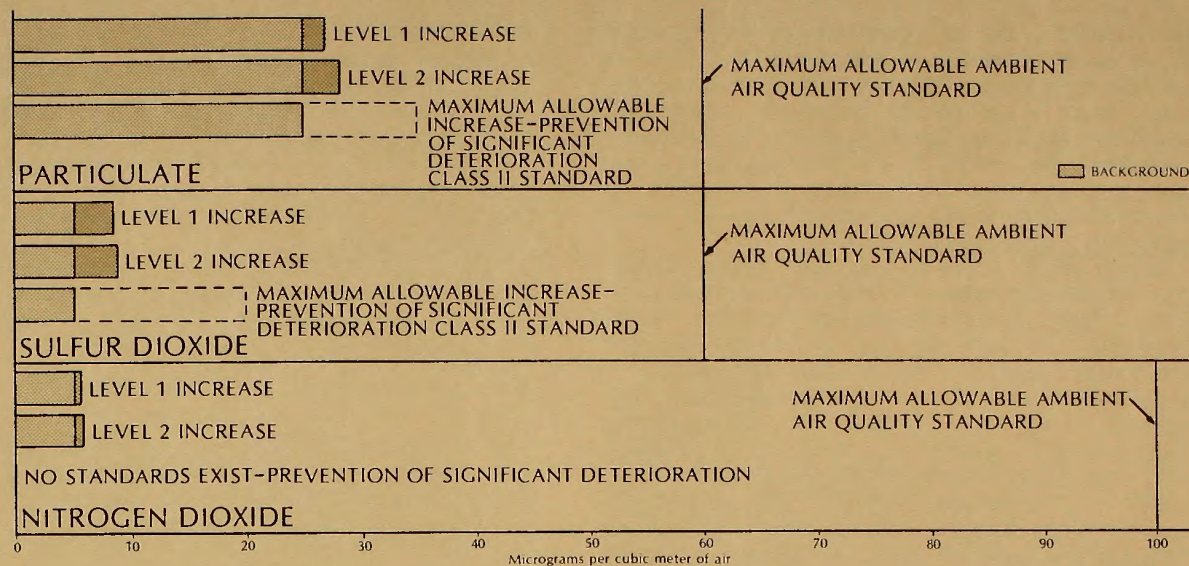


FIGURE 4: RELATIONSHIP OF CONTAMINANTS TO STANDARDS/ANNUAL AVERAGE

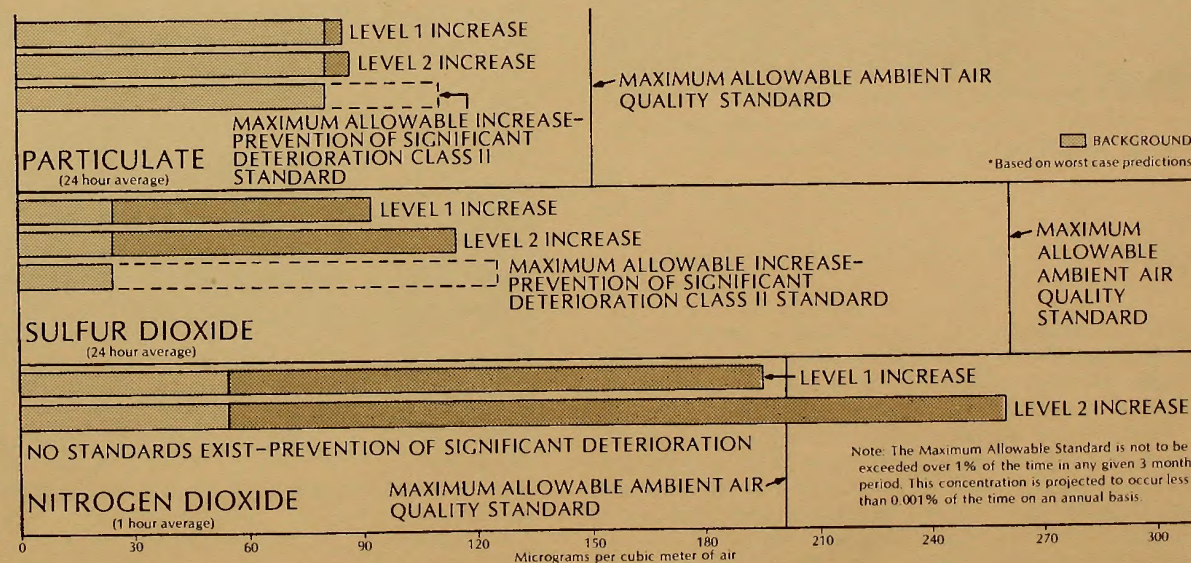


FIGURE 5: RELATIONSHIP OF CONTAMINANTS TO STANDARDS/SHORT TERM*

cants are committed to construction of facilities which insure proper dispersion of emissions. The applicants are also committed to utilization of pollution control devices. These would include electrostatic precipitators and fabric filters, to reduce most of the particulate mass from stack exhausts, and sulfur absorption systems to reduce sulfur dioxide emissions. Oxides of nitrogen emissions would be reduced through burner design and recirculation of flue gases.

Each of the proposed actions must comply with federal and state air quality standards and emission regulations. State standards adopted by the North Dakota Department of Health are equal to or more stringent than federal standards. The state has deemed any air contamination unacceptable if it adversely affects sensitive or susceptible segments of the population; causes public nuisance or annoyance; significantly harms animals, ornamental plants, and forest and agricultural crops; significantly reduces visibility; significantly corrodes or damages metals or other materials; affects fabric durability and color; or obscures natural scenery. Regulations governing the issuance of permits for both construction and operation of plants and mines require the application of best available control technology and insure adherence with federal and state Ambient Air Quality Standards, Prevention of Significant Deterioration of Air Quality Regulations, and New Source Performance Standards. Permit conditions stipulate continued environmental monitoring during operation in order to determine actual air quality effects and to identify problem areas requiring additional mitigation through established enforcement procedures.

RESIDUAL IMPACTS

Some modification of microclimates would occur due to plant and mining operations, although the changes would not impact larger scales of weather and would not likely be noticed.

Although the implementation of mitigating measures would prevent any significant alteration of existing air quality, a general reduction in the overall ambient air quality in the seven county study area would occur for the duration of the project lifetimes. This would reduce the amount of deterioration allowable under the Prevention of Significant Deterioration of Air Quality Regulations for Class II areas and could restrict future devel-

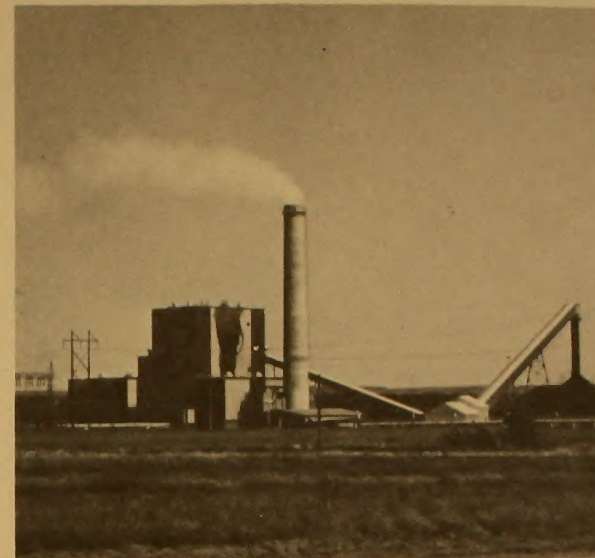
opment potential.

Localized episodes of fugitive dust and particulate concentrations due to mining and plant construction would be noticeable but would not exceed permissible standards outside property boundaries.

Total photochemical oxidant concentrations could exceed federal and state Ambient Air Quality Standards. However, sufficient data is not available to predict potential adverse impacts.

The ambient air residence time of contaminant emissions would normally vary between a few hours and a few days. Long term increases of major pollutants are not expected to occur.

Note: The analysis reflecting the 1977 amendments to the Clean Air Act was not completed in time to be included in this study but information would be available from the North Dakota State Health Department.



UPA's Stanton Plant prior to installation of electrostatic precipitators.



Dust from mine haul roads contributes to particulate concentrations.

The geologic analysis addresses topography, stratigraphy, mineral resources, and fossil resources.

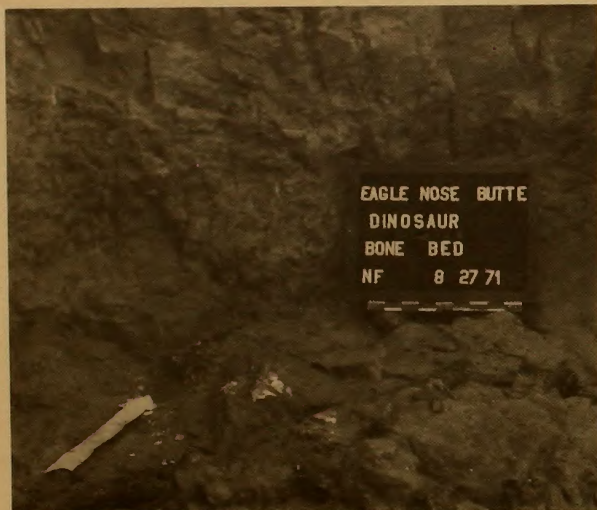
The Missouri River Trench serves as a transition between the glaciated deposits and hummocky topography of the northeastern portion of the seven county study area and the less glaciated, eroded, rolling prairie topography of the southwestern portion.

The area stratigraphy shows coal beds of economic interest occurring primarily in the Tongue River and Sentinel Butte Formations of the Fort Union Group, as presented in Figure 6. Strip mining of these beds requires removal of the sediment and rock overburden consisting mainly of siltstone, claystone, and fine-

grained sandstone. The clay content and sodium rich character of the overburden limits vegetative growth, requiring stockpiling and replacement of all suitable topsoil and plant growth material.

North Dakota coal is a high moisture, low ash and sulfur, lignite with heating values ranging from 5,950 to 7,510 British thermal units per pound. Estimated reserves of stripping coal in the seven county study area, excluding Burleigh and Morton Counties, total 11.6 billion tons. In addition to coal, other mineral resources in the area include oil, natural gas, leonardite, sand and gravel, and scoria.

Fossils contained in the exposed formations of western North Dakota consist of plant as well as vertebrate and invertebrate animal remains.

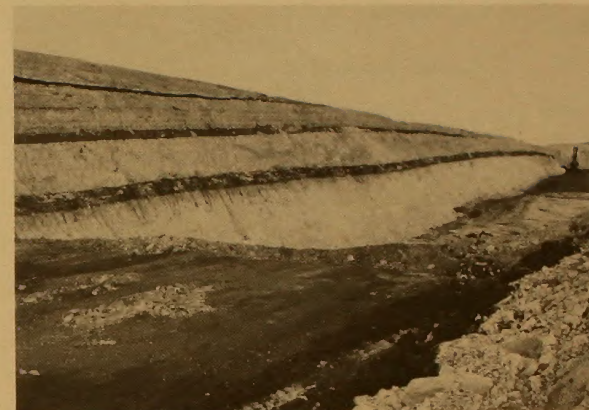


An exposed dinosaur bone bed.

MAJOR IMPACTS

Mining disruption and subsequent reclamation would result in a slightly modified topography on 34,217 acres in Level 1 and 76,017 acres in Level 2. Additional topographical modifications would occur along pipeline rights-of-way.

Surface coal mining would destroy the layering, compactness, and cohesion of the sedimentary formations that lie above the coal veins. The original stratification of beds of different grain size and chemical characteristics would be replaced by less consolidated material possessing altered chemical properties. Since the mining operation usually inverts the overburden, the deepest layers, often with undesirable amounts of exchangeable sodium, are eventually placed on top of spoil banks and regraded nearest the surface. Any mix-



The mine highwall reveals multiple coal seams.

ture of glacial drift with highly sodic overburden would adversely affect derived soil material.

Engineering studies would be needed to determine the stability and load bearing properties of reclaimed land prior to any building construction.

Mining operations would increase opportunities for geologists to observe and interpret the intricate stratigraphic features of formations exposed by mining. Such geologic observations have, in the past, led to new mineral discovery and development.

Coal removal and consumption would be an irretrievable commitment of a nonrenewable natural resource. Mining during Level 1 would reach a peak production rate of 34.5 million tons per year by 1983. Tentative projects would produce another 22.3 million tons per year, resulting in a cumulative Level 2 total of 56.8 million tons per year by 1990, 1.7 billion tons over a 30-

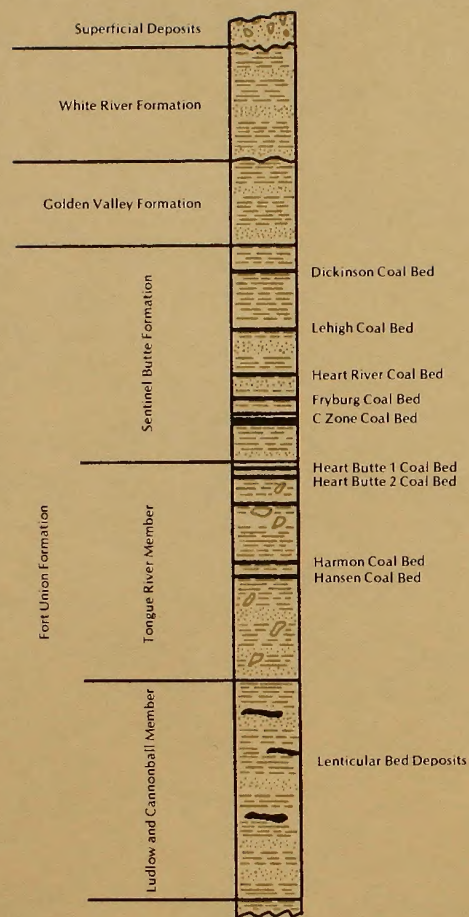


FIGURE 6: COLUMNAR SECTION OF SEDIMENTARY FORMATIONS

year period. Total production, shown in Figure 7, represents about 15% of the 11.6 billion tons of estimated stripping reserves. Coal recovery within Federal Coal Study Areas could total 2.5 billion tons, of which 541 million tons would be federal coal.

Spontaneous combustion is a possible hazard whenever coal is exposed and could result in coal resource losses and air pollution.

Mining would also destroy thin coal beds in the overburden which cannot presently be mined at a profit. A one-foot thick bed, uniformly distributed over the 76,017 acres of disturbed Level 2 land, would represent approximately 133 million tons of coal.

Mineral resources other than coal would also be affected by mining operations. The presence of oil or gas drill rigs or wells in mining areas could result in production delays or some coal left unmined. New oil discoveries in Dunn County have increased the potential for this type of conflict. An indeterminable, but substantial, amount of leonardite (oxidized coal) would be removed during mining. Estimates for the AMAX Mine indicate that 1,100 tons of leonardite would be extracted and discarded for each acre mined.

Sand and gravel would be quarried from nearby deposits for use as concrete aggregate and railroad-bed ballast. It is estimated that at least 358,000 cubic yards of sand and gravel would be used for the two coal gasification projects in Level 1. Tentative mine projects could require an additional 205,000 cubic yards for rail ballast and construction purposes, bringing the possible commitment of sand and gravel to at least 563,000 cubic yards, excluding amounts needed for three generating stations. Large quantities of scoria (baked and fused rock) would also be quarried for use in surfacing coal haulage and access roads.

Fossil resources would be affected by mining and quarrying. These operations would obliterate the relationship of any fossils contained in the overburden; coal beds; or sand, gravel, and scoria deposits. However, fossil material of scientific or economic value may also be uncovered, providing a better understanding of the area's paleontological history.

MITIGATING MEASURES

Federal and state reclamation laws require advance preparation of mining plans, compilation of baseline

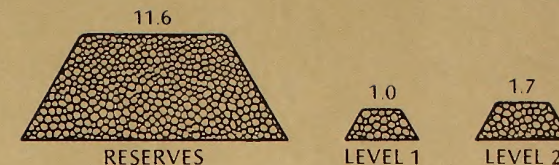
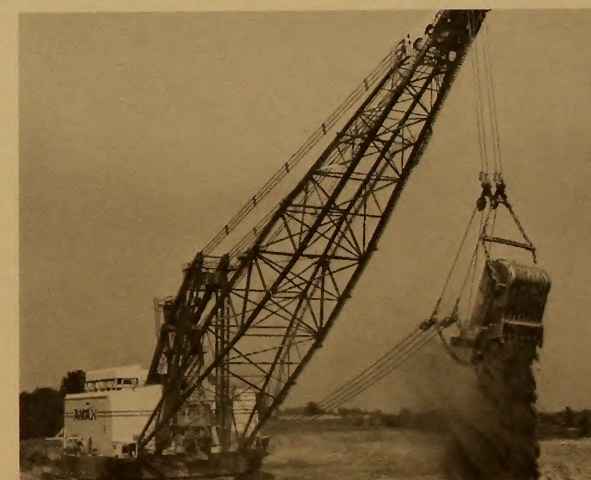


FIGURE 7: RELATIONSHIP OF PROJECT COAL PRODUCTION TO ESTIMATED RESERVES (billions of tons)

data, and specification of reclamation procedures. Mine operators must segregate and stockpile topsoil for later respreading. Mine areas would be regraded to the gentlest topography consistent with adjacent unmined land in order to provide maximum moisture retention, maximum stability, and minimum erosion. The operator must re-establish drainage patterns, compatible with the topography, to control runoff water and lessen erosion. The federal government has agreed to state administration and enforcement of mining and reclamation laws.

Compliance with federal regulations regarding maximum economic resource recovery would be required. Mine operators would also be required to cover any exposed coal faces with non-combustible material to pre-



Strip mining begins with removal of topsoil and overburden.

vent spontaneous combustion where mine operations have been indefinitely suspended or terminated.

Coal mining near any oil or gas wells would be monitored by the North Dakota Public Service Commission and the U.S. Geological Survey in order to protect the wells and obtain maximum coal recovery.

Intensive ground surveys of mine areas, construction sites, and transmission rights-of-way could be required to identify locations with significant fossil remains. To protect such locations, projects could be modified or the fossils removed. Clinker and sand and gravel deposits in mine areas could be quarried prior to mining and stockpiled for later use. Consideration could also be given to development of markets for leonardite.

RESIDUAL IMPACTS

Mining disruption and subsequent reclamation would result in a slightly modified topography on 76,017 acres of mined land.

Mining would destroy the layering, compactness, and cohesion of the sedimentary formations that lie above coal beds, possibly altering the chemical properties of the soil.

The stability and load bearing properties of reclaimed

land may be temporarily lessened.

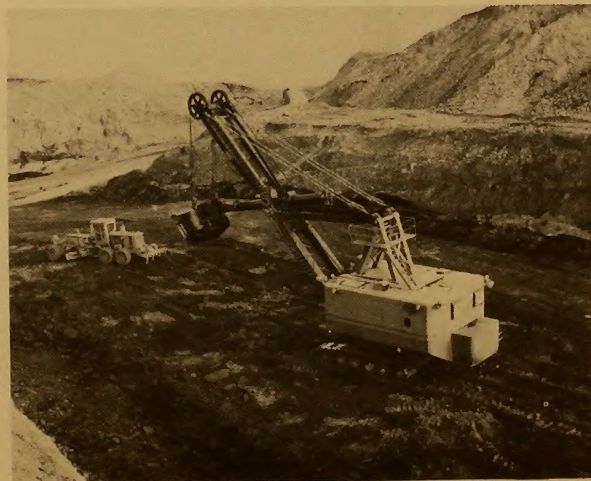
Mining over a 30-year period would result in the removal and consumption of 1.7 billion tons of coal, an irretrievable commitment of a nonrenewable resource. Thin coal beds would also be destroyed if unprofitable to mine. Recovery of some coal may be prevented due to conflicts with oil and gas wells.

Substantial quantities of sand, gravel, and scoria would be consumed for construction of plants, mines, and related facilities. Leonardite in the mine areas would be mixed with the overburden and wasted.

Some fossils would be lost due to mining and quarrying operations and to private collecting.



The coal seam is then exposed for drilling and blasting.



Smaller shovels load the fractured coal into coal haulers.



Finally, the overburden and topsoil are replaced.



Soils

Seven county study area soils were formed primarily from glacial tills, shale, siltstone, and sandstone, with additional materials derived from water-deposited alluvium and windblown sands. The predominant units consist of upland soils formed in glacial till and soft bedrock. About 71% of the area soils are clay loams or loams. Another 18% are sandy and sandy loam soils. Although steep slopes along river drainages interrupt the gently rolling topography, 86% of the seven county study area has soil slopes of less than 9%. Based on general soil survey analysis, 30% of the area is classified as prime farmland capable of producing sustained high crop yields.

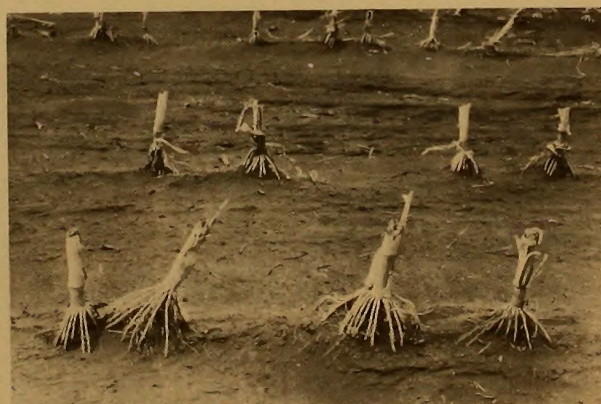
Soil susceptibility to water and wind erosion can determine the management systems needed for sustained agricultural production and watershed quality. Approximately 45% of the seven county study area soils are highly susceptible to water erosion. In addition, 15% of the area is rated as having severe wind erosion susceptibility. About 20% of the area has high hazard sodium affected soil material within 30 inches of the surface. Sodium affected soils are characterized by low water infiltration and reduced root penetration.

MAJOR IMPACTS

Mining during Level 1 would disturb 34,217 acres of land. Tentative mining projects would disturb another 41,800 acres for a cumulative Level 2 total of 76,017 acres. Additional acreage would be temporarily disturbed for electrical transmission line and pipeline installation and would be permanently disturbed for plant siting.



Some mined lands would be highly susceptible to water erosion.



Wind erosion could also affect mined lands.

Project areas in Level 1 contain 1,900 acres of prime farmland, based on general soil surveys. Tentative mining projects include another 4,100 acres of prime farmland. Prime farmland constitutes about 3% of the Level 3 areas and about 2,000 acres are located within the Federal Coal Study Areas.

Because mining operations would leave land barren for varying periods of time, water erosion is a major concern. The amount of erosion occurring is directly related to the time span between initial stripping and final re-establishment of vegetation. The maximum potential loss of topsoil with high erodibility and steep slopes over long distances could amount to 118 tons per acre annually. Water erosion susceptibility is high in the Glenharold and Coteau Mine areas; the Glen Ullin and New Salem Level 3 areas; and Federal Coal Study Areas S-2A, S-3, N-2A, and N-3B.

Like water erosion, wind erosion susceptibility is influenced by the length of time between initial stripping and final re-establishment of vegetation. In instances where shaley subsoils are exposed over long distances and are aligned with the wind direction, annual soil losses of up to 51 tons per acre are possible. Wind erosion hazard potential is greatest in the South Beulah Mine area associated with the Coyote 1 and 2 Power Plants, the Dickinson-Dunn and North Beulah-Hazen Level 3 areas, and potential Federal Coal Study Area N-3B.

Exchangeable sodium is a principal consideration in determining plant growth material suitability. When found at the surface or in the plow layer, it causes soil aggregated destruction or dispersion and crusting. Mining of these soils would result in reclamation difficulties if plant growth material is unavailable in sufficient quantities to rebury the sodium affected soils at suitable depths. Sodium affected soils are found in the Glenhar-

old and AMAX Mine areas, the Dakota Star Mine project area, and Federal Coal Study Area S-3.

Preliminary soil surveys indicate that sufficient suitable plant growth material is available to bury sodium affected soils with at least 30 inches in all but 335 acres of the mining areas in Level 1. The Glenharold Mine area includes 230 of these acres, with the AMAX Mine accounting for the remainder. Of the tentative

mine proposals, the Dakota Star Mine project area would lack sufficient plant growth material over approximately 1,000 acres. About 19% of the Level 3 areas lack the necessary 30 inches of plant growth material needed for sodium affected soils. A similar situation exists on 8,000 acres of the Federal Coal Study Areas, about 4% of the total acreage, with the greatest concentration in the S-3 area. Possible reclamation hazard potential, due to erosion or sodium affected soils, is shown in Figure 8.

Figure 9 indicates reclamation suitability of mine areas for Levels 1 and 2 and Federal Coal Study Areas. The suitability ratings consider soil texture, consistency, stoniness, inherent fertility, and lime content. The most suitable soils have between 30 to 60 inches of topsoil. The Glenharold and AMAX Mine areas have less than 50% of their soil classified as suitable for reclamation or better. All of the tentative mine project areas have over 70% of the soils classified as suitable or better. The Glen Ullin and New Salem Level 3 areas have least suitable ratings for over 85% of the areas, generally due to sodium affected soils. Federal Coal Study Areas S-2A, S-3, and S-5 may also have significant amounts of land difficult to reclaim, again due to sodium affected soils. The least suitable ratings should not be construed as prohibitive to mining, but they are indicative of potential reclamation problems and more

detailed site-specific study is needed.

It is estimated that respread soil material can expand 20 to 25% in volume. This expansion, coupled with subsurface channeling of water flow in the fine textured materials predominant in the overburden, could form underground cavities. These cavities would contribute to unstable surface condition with possible slumping or cave-ins of up to several cubic feet in volume.

MITIGATING MEASURES

North Dakota law requires restoration of mined land to 100% of its original productivity. The state assumes responsibility for completion of reclamation in the event the mine operator fails. Both federal and state statutes also require separate lifts and stockpiling of topsoil and subsoil as well as eventual resspreading over graded spoil piles.

North Dakota energy conversion facility siting regulations exclude prime farmland from siting consideration. Where mining would occur on prime farmland, new federal laws stipulate special permit requirements to insure adequate protection and replacement of the A, B, and C soil horizons and proper reclamation.

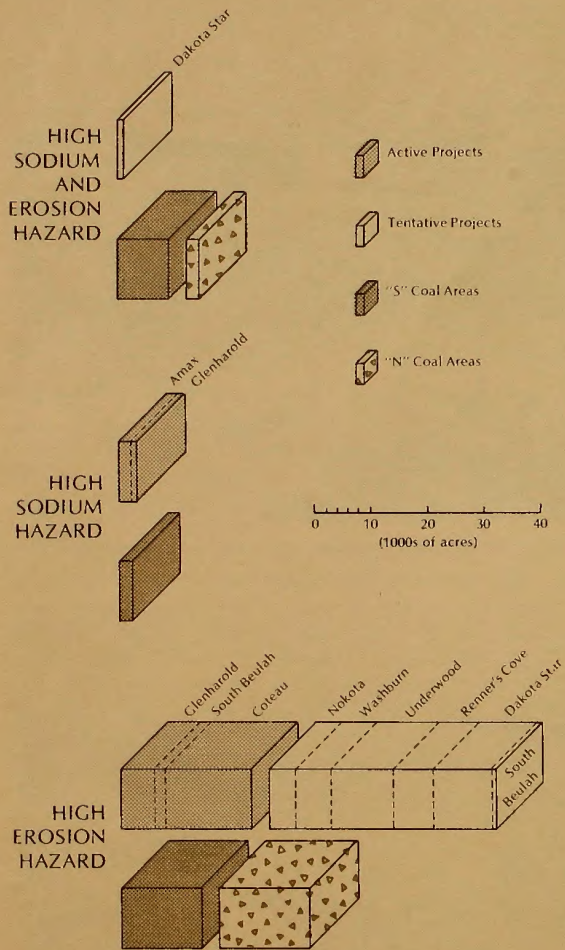


FIGURE 8: POSSIBLE RECLAMATION HAZARDS



Check plot indicates sufficient amounts of topsoil have been removed before mining.



Leveling and reshaping of spoil banks.

Federal law requires that the mining operator reclaim affected lands as contemporaneously as practicable to minimize acreage lacking vegetation. Vegetative cover would be established on stockpiled topsoil to prevent irretrievable water and wind erosion losses. Reshaping the land to the most gentle topography consistent with surrounding terrain would lessen the risk of water erosion by as much as 50%. Mechanical compaction and respreading of topsoil materials possessing physical properties similar to underlying soils would diminish

subsidence and soil piping hazards.

Burial of sodium affected soils with at least 30 inches of suitable plant growth material could alleviate most potential reclamation problems due to crusting, sealing, or unsuccessful revegetation.

Other federal and state enforceable measures require topsoil segregation and replacement on pipeline routes to insure proper reclamation.

RESIDUAL IMPACTS

Mining would disturb 34,217 acres in Level 1 and an accumulated total of 76,017 acres in Level 2. Current land productivity would be interrupted during mining operations and reclamation.

Water and wind erosion losses would be the most significant residual impacts, despite measures which could be taken to lessen the magnitude of the losses. Combined measures of slope, water, and wind erosion susceptibilities show 24% of the mine areas in Level 1 with high potential erosion losses. About 20% of the tentative mine project areas have a high erosion potential. Overall, 22% of the mine areas in Level 2 have a high erosion potential.

Cave-ins and slumping associated with soil subsidence and piping hazards would be possible in the mined areas.

Shortages of suitable plant growth material in areas with sodium affected soils could adversely affect reclamation success and post-mining productivity on approximately 1,335 acres in Level 2 and 8,000 acres of Federal Coal Study Areas.

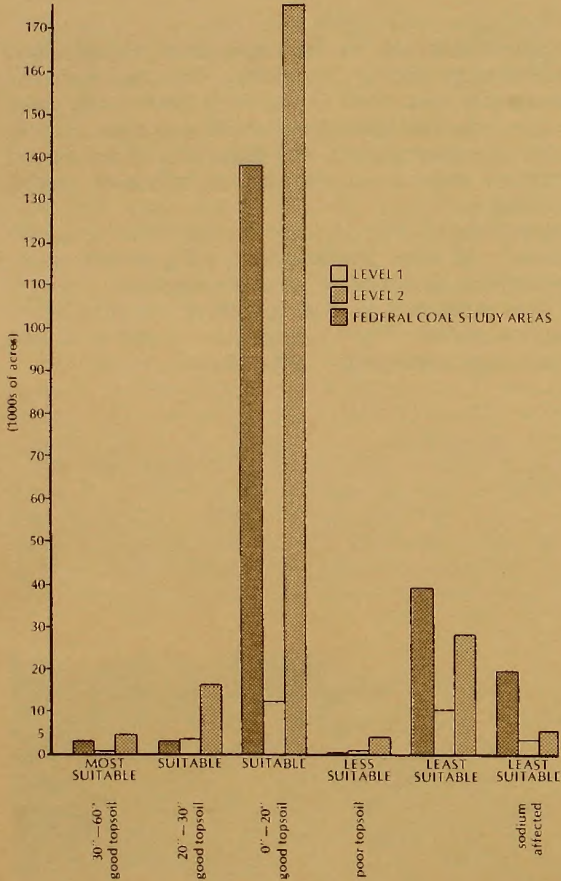


FIGURE 9: MINED LAND RECLAMATION SUITABILITY



USDA Agricultural Research Service mining reclamation test plot.



Former mine area reclaimed to needle and wheat grasses.



Water

Water use in the seven county study area depends upon surface and ground water availability and suitability. Surface water resources include Lake Sakakawea, the Missouri River below Garrison Dam, the Knife and Heart Rivers, and various lakes, ponds, and sloughs. Figure 10 illustrates the area's annual water use. Evaporation from Lake Sakakawea and other water bodies comprises 89% of the surface water depletion. Agricultural and industrial uses account for 7% and 3% respectively, with the remaining 1% used by municipalities.

Ground water is found in aquifers in either consolidated or unconsolidated rock material. Agricultural use for irrigation and stock ponds accounts for 74% of the ground water withdrawals, with rural domestic and municipal consumers using another 23%, and industry using the remaining 3%.

Of the water withdrawn, the portion not consumed becomes municipal discharge, irrigation seepage, industrial return flow, or waste from livestock watering. In addition to the agricultural, industrial, and municipal uses cited above, seven county study area water resources are used for non-consumptive purposes such as hydroelectric power generation, wildlife habitat, fishing, boating, and other recreational activities.

MAJOR IMPACTS

Figure 11 shows projected water use for all active and tentative projects. The withdrawal of 51,150 acre-feet of water annually from Lake Sakakawea and the Missouri River below the Garrison Dam, for the NGPL and ANG Coal Gasification Plants and the Antelope

Valley and Coyote 1 Power Plants, would reduce the potential hydroelectric power generation from Missouri River dams from Garrison to Gavin's Point. Based on Bureau of Reclamation calculations, projects in Level 1 would cause a potential loss in generating capacity of 22.6 million kilowatt hours. The tentative Coyote 2 Power Plant would withdraw another 10,000 acre-feet annually, for a Level 2 total of 61,150 acre-feet and a generating capacity loss of 26 million kilowatt hours. This represents a loss of 0.28% of the normal generation by Garrison and downstream dams. Withdrawals from the Missouri River below Garrison Dam would ac-

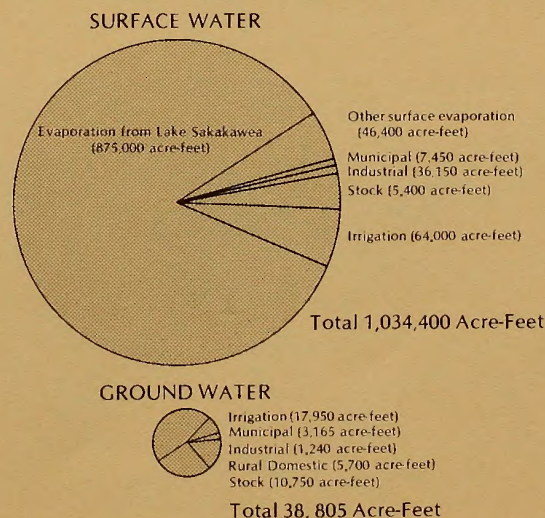
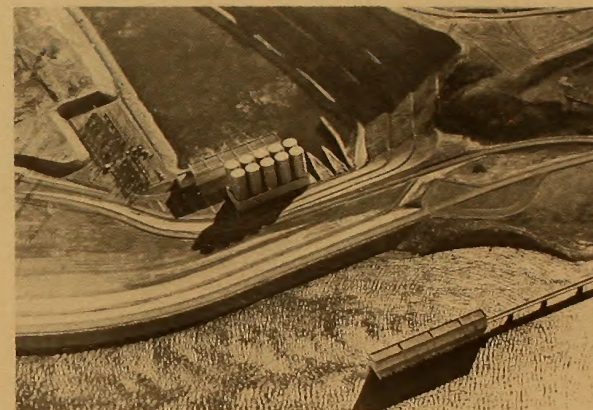


FIGURE 10: ANNUAL WATER USE



Water withdrawals would reduce the potential generating capacity of Garrison Dam.

count for less than 0.17% of the anticipated minimum river flow.

Streamflows would also be reduced by mining operations. Percolation of water into raw or reclaimed spoil piles, transpiration by newly established vegetation, and dust control measures would also contribute to the water loss. Average precipitation of 16 to 18 inches per year produces about 1 inch of runoff from unmined land. Increased infiltration, transpiration, and mine interception of runoff could reduce mine area contributions to streamflow to nearly zero.

Increased population would create demand for new or expanded municipal water and sewage disposal facilities. New residents associated with the NGPL Coal Gasification Plant could burden Dickinson facilities, where the Lake Patterson water supply is already insuf-

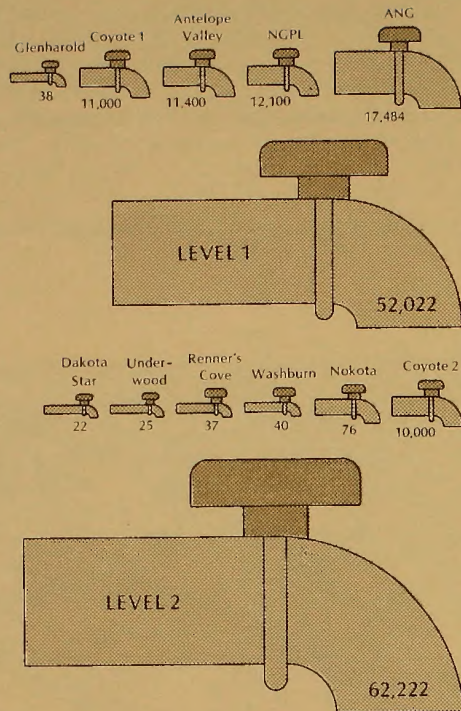


FIGURE 11: TOTAL WATER USE
(acre-feet per year)

ficient. Level 3 development in Morton and Stark Counties could seriously impact nearby communities lacking adequate water resources.

Small surface water bodies, sloughs, and ponds would be affected by mining activities during Level 1 and 2. Lowered water tables could shrink or dry up some of these water bodies, impacting vegetation and animal life. The potholes and glacial sloughs found in the Garrison and Underwood Level 3 areas could be reduced or lost. Direct or indirect water quality degradation would occur due to higher dissolved solids in mine runoff and eventual solution of particulate emissions and gases from the stacks of proposed conversion facilities.

Mining would affect consolidated aquifers, drying up springs and lowering well water levels not only at mine

sites, but as far as one mile away. The water table or artesian pressure surface in adjacent unmined areas would be lowered as the aquifers drain toward the mines.

Mining would precipitate similar water quantity problems where unconsolidated aquifers are disrupted. These aquifers would also be affected by increased concentrations of mine waste dissolved solids, such as sodium sulfate and sodium bicarbonate, and increases in other dissolved solids from disposed ash and sludge. Initially, this water degradation would affect ground water quality within the mine areas. However, later migration of water would carry the solids into unmined areas and, eventually, streams. Aquifers in melt-water channels adjacent to mine sites could be degraded to the extent they are less suitable irrigation water sources than at present. Delayed settling of reclaimed land could produce an uneven surface and alter planned drainage patterns.

MITIGATING MEASURES

Inherent in the various project proposals is the understanding that federal, state, and local regulations, particularly those establishing water quality standards,

would be observed.

The State Health Department has required that retention dams and holding ponds be provided at some mines. These dams control runoff, preventing discharge of sediment to streams, and allow any necessary treatment prior to discharge into surface water bodies. Surface water protected would include Lake Sakakawea, Antelope Creek, Spring Creek, Aldrin Creek, and the Knife River.

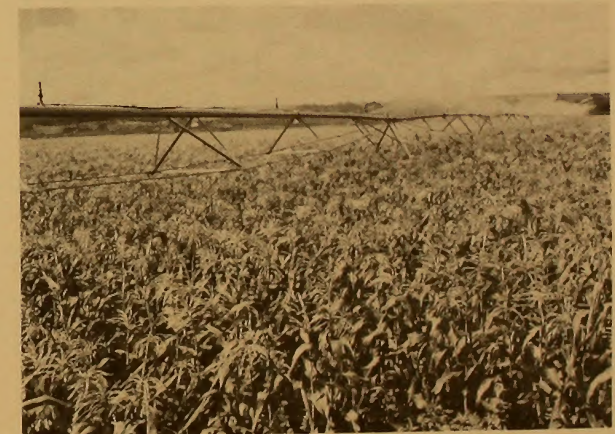
All waste water discharges from the Antelope Valley and Coyote 1 Power Plants would be regulated by the North Dakota State Health Department to prevent reductions in water quality.

Mine operators must show that disposal of ash and other conversion facilities wastes would have no detrimental effect on vegetation or water before North Dakota Public Service Commission mining approval is granted. Intermixing of wastes throughout spoil areas or special treatment of ash and sludge to reduce solubility could slow the rate of leaching and diminish contamination hazard.

Where wells or springs are destroyed by mining, or where water tables are lowered because of adjacent mining, the mine operators are committed by federal and state statutes to replace lost water supplies. Mine operators are also committed to replace water supplies where wells or springs are contaminated. This commitment applies to both the actual mine site and peripher-



Coyote 1 and 2 Power Plants would withdraw water from the Missouri River.

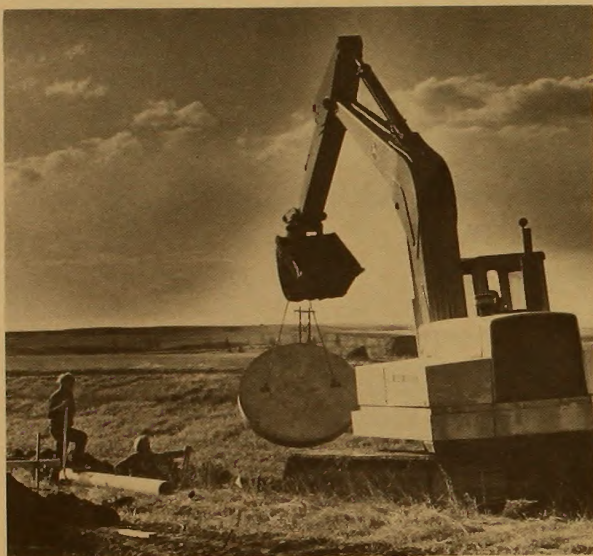


Mining can be prohibited if irrigation or municipal water supplies are endangered.

al areas. Replacement wells would have to be drilled to deeper aquifers.

Both federal and state statutes provide for denial of mining permits where operations would jeopardize water supplies. Where mining of federal coal would endanger irrigation or municipal water supplies obtained from adjacent melt-water channels, mining would be prohibited if mitigation is not possible.

Loss of aquatic habitat could be mitigated through the reclamation process, but only if surface owners request that small bodies of water, sloughs, or wetlands be re-established.



Expansion of the Hazen city lagoon.

RESIDUAL IMPACTS

Some residual impacts, such as stream sedimentation, would gradually be reduced as natural and artificial processes and agents modify the immediate post-reclamation environment. Others, such as water depletion, would persist only during the conversion facility operating life. Still others, such as destruction of aquifers, would be permanent.



Direct and indirect water quality degradation would occur due to mining.

Water withdrawals of 51,150 acre-feet for Level 1 and 61,150 acre-feet for Level 2 would result in a potential generating capacity loss of 22.6 and 26 million kilowatt hours, respectively.

Stream flows would be reduced, and ponds, sloughs, and wetlands in mining areas would be permanently destroyed unless restoration is requested by surface owners.

Destruction of all aquifers above the base of the lowest coal bed mined is inescapable. Water tables, springs, and wells in the mine and nearby areas would be affected.

Water in the mine areas would be chemically degraded. Percolation through spoil materials would increase sodium bicarbonate and sulfate content. Waste ash and sludge would add dissolved solids. Water migrating from mined areas could enter adjacent melt-water aquifers reducing water quality and irrigation use.

New residents in the Beulah, Hazen, and Dickinson areas would overtax municipal water and sewage disposal systems, requiring capital expenditures for expansion of wells, storage reservoirs, and sewage lagoons.

Delayed settling of reclaimed land could produce an uneven surface, including shallow depressions, which would alter drainage patterns.



Vegetation

Cropland comprises about 50% of the ground cover in the seven county study area. Wheat, oats, barley, rye, and corn are the principal crops. Dryland farming practices include crop rotation, summer fallow, and strip cropping.

Native prairie accounts for 42% of the area and is comprised of grassland, shrubland, and woodland. Grassland covers 37%, shrubland covers 1%, and woodland covers 4% of the native prairie. Although

shrubland and woodland constitute a relatively small portion of the total area, they are extremely important wildlife habitat.

Wetland, which is scattered throughout the area, is most abundant in McLean County. While wetland comprises only 2% of the total area, it is vital to waterfowl and other wildlife species.

Badlands cover about 2% of the seven county study area, primarily in Dunn County.

The remaining 4% of the area is water surface.

About 10,246 acres of land, or 0.1% of the total area, have been mined. Approximately half of this mined acreage is subject to reclamation law although vegetation has been re-established on only a small portion.

No plant species in the seven county study area are classified under federal law as threatened or endangered. However, a total of 14 species have been identified as unique or rare in North Dakota.

MAJOR IMPACTS

Vegetative damage would occur primarily as a result of mining, plant siting, new transmission lines and pipelines, and other associated land disturbance. Projects in Level 1 would disturb 49,470 acres while projects in Level 2 would disturb 92,461 acres. As indicated in Figure 12, these various energy related activities would disturb land for different lengths of time.

Level 1 and 2 ground cover disturbance is depicted in Table 2. Cropland would comprise 52% of the total land disturbance from projects in Level 1 and 62% from projects in Level 2. The higher Level 2 cropland percentage is attributable to greater concentrations of cropland in the Nokota, Underwood, and Washburn Mine project areas. Grassland would account for 47% of the Level 1 disturbance and 32% of the Level 2 disturbance. Reclamation would probably result in changes in grassland species composition.

Revegetation problems could occur in areas with sodium affected soils and less than 30 inches of suitable plant growth material. These characteristics are found in the AMAX, Glenharold, and Dakota Star Mine

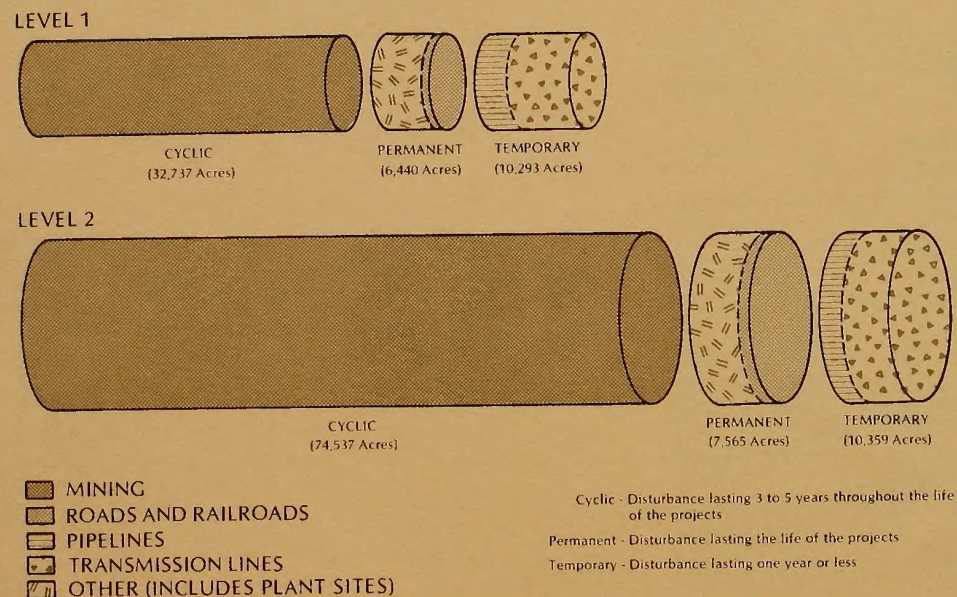


FIGURE 12: LAND DISTURBANCE BY ACTIVITY AND TYPE



Reclaimed land seeded to wheat.

project areas.

Ground cover disturbance would result in a loss of cereal grain production, grazing productivity, and wildlife habitat. Figure 13 shows estimated production losses for wheat, the principal crop, and forage.

The existing ground cover distribution would change if landowners choose to reclaim land to different uses.

No rare or unique plant species have been located within the Level 1 or tentative project areas.

Because Level 1 and 2 air contaminant emissions and ground level concentrations are expected to comply with federal and state standards, it is unlikely that individual air contaminants would measurably affect vegetation. However, vegetative damage has been observed elsewhere at contaminant levels well below federal and state standards, possibly due to a synergistic effect caused by two or more contaminants acting together.

Vegetative damage due to land disturbance or air contaminants would not occur on the Fort Berthold Reservation.

Wetland concentrations in the Beulah-Center, Garrison, North Beulah-Hazen, and Underwood Level 3 areas would be highly sensitive to mining, as would badland ecosystems in the Dickinson-Dunn area due to

the presence of shrubland and woodland.

Vegetation impacts in the Federal Coal Study Areas would be similar to those in the active and tentative project areas.

MITIGATING MEASURES

Federal and state reclamation laws require that mined land be restored to its original productivity. Revegetation of mined land in the seven county study area is dependent upon efficient use of limited precipitation, replacement of subsoil and topsoil, and burial of sodium affected soils with at least 30 inches of suitable plant growth material. Cropland and cool season grasses would be the least difficult ground cover to reclaim. The chance of reclamation success would decrease with warm season grasses.

Most disturbed cropland and grassland would likely be reclaimed to at least original productivity and, in some cases, to greater than original productivity. However, different levels of management may be required

TABLE 2
GROUND COVER DISTURBANCE¹
(Acres)

Ground Cover	Level 1				Level 2			
	Cyclic	Permanent	Temporary	Total	Cyclic	Permanent	Temporary	Total
Cropland	16,962	3,644	5,267	25,873	48,393	4,441	5,310	58,144
Grassland	13,495	2,661	4,287	20,443	22,501	2,962	5,308	29,771
Shrubland	969	14	100	1,083	1,038	15	100	1,153
Woodland	1,252	55	388	1,695	1,861	62	388	2,311
Badland	—	62	135	197	253	67	135	455
Wetland	59	4	116	179	491	18	118	625
TOTAL	32,737	6,440	10,293	49,470	74,537	7,565	11,359	92,461

¹Cyclic disturbance would last three to five years throughout the life of the projects. Permanent disturbance would last the life of the projects. Temporary disturbance would last one year or less.



Spoil bank leveled and terraced for tree planting.

to sustain productivity over time.

Difficulties would probably occur in reclaiming most native shrubland, woodland, and wetland. Where reclamation is possible, original ecosystems, which are often vital to wildlife, would not be fully restored. To date, reclamation of these vegetative types has not been proven.

Both federal and state statutes require that topsoil be saved, segregated, and respread. Topsoil stockpiles would be protected from toxic substances and seeded with a cover crop if left for extended periods of time.

North Dakota energy conversion facility siting regulations exclude national and state grasslands, state forest land, hardwood draws, enrolled woodlands, and habitat of threatened or endangered and unique or rare species from siting consideration. Woodlands and wetlands are avoidance areas.

Additional federal and state enforceable measures could insure that vegetative impacts associated with transmission line and pipeline installation would be minimized. Areas containing threatened or endangered species and unique or rare plant species are excluded from transmission line siting under North Dakota law. National and state grasslands, state forests, hardwood draws, woodlands, and irrigated land are avoidance areas.

Mining of hardwood draws should be avoided where difficulties would be encountered in reestablishing vegetation.

Non-enforceable measures include agreements by landowners to reclaim land to its original use, burial of sodic overburden at least 30 inches below the root zone, and irrigation of new vegetation for a two to three year period.

RESIDUAL IMPACTS

Project land disturbance would total 49,770 acres for Level 1 and 92,461 acres for Level 2. Cropland would comprise 52% of the Level 1 disturbance and 62% of the Level 2 disturbance. Grassland would account for 47% of the ground cover disturbance with Level 1 and 32% with Level 2.

Residual vegetative impacts would occur where land is not reclaimed to its original productivity, where reclaimed land requires more intensive management

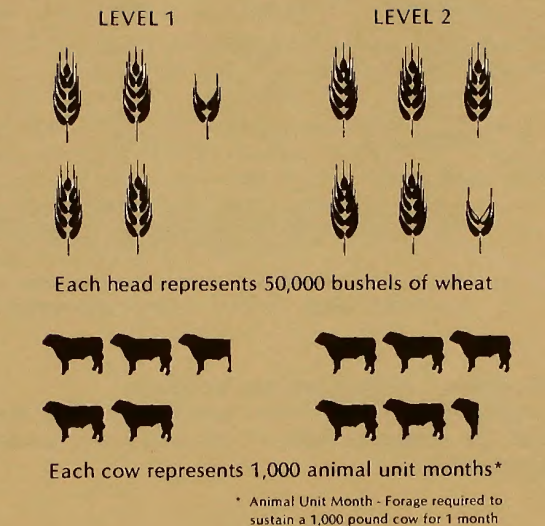


FIGURE 13: ANNUAL PRODUCTION LOSS

levels, or where sodium migrates into plant root zones. Native shrubland, woodland, and wetland would be lost if these ground cover types are not reclaimed to their original species composition.

Level 1 and 2 land disturbance would result in a loss of cereal grain production, grazing productivity, and wildlife habitat.

Landowner reclamation decisions could change the existing ground cover distribution.

Vegetative damage could occur due to increased air contaminant emissions and ground level concentrations as a result of Level 1 and 2 development, even though all air quality standards are met.



Difficulties are encountered in reclaiming hardwood draws.



Animals

Wildlife habitat and numbers in the seven county study area have historically declined due to intensive agricultural, transportation, and mining activities. For some species, the reductions have been severe. However, a few species, such as the horned lark and white-tailed deer, have increased because of man's activities and others, such as the pheasant and Hungarian partridge, have been established.

Without the proposed action, future trends could be expected to show stable or slightly declining populations. Expansion of intensive agricultural practices would contribute to small reductions in habitat. Non-game species especially tolerant of man, such as songbirds and some small mammals, would probably increase.

Domestic animal populations vary in response to fluctuating market conditions.

Cattle dominate livestock production in the seven counties.

Mule deer, white-tailed deer, and antelope comprise the seven county study area's big game species. A variety of upland game birds, waterfowl, furbearers, small mammals, raptors, non-game birds, reptiles, fish, and invertebrates are also found in the area. Among the endangered species occasionally sighted in the seven county study area are the whooping crane, northern bald eagle (nominated for endangered status), and American and Arctic peregrine falcons. Other endangered species which possibly could occur in the area include the black-footed ferret, swift fox, and Eskimo curlew. Map 5 denotes locations where some endangered species have been sighted.

MAJOR IMPACTS

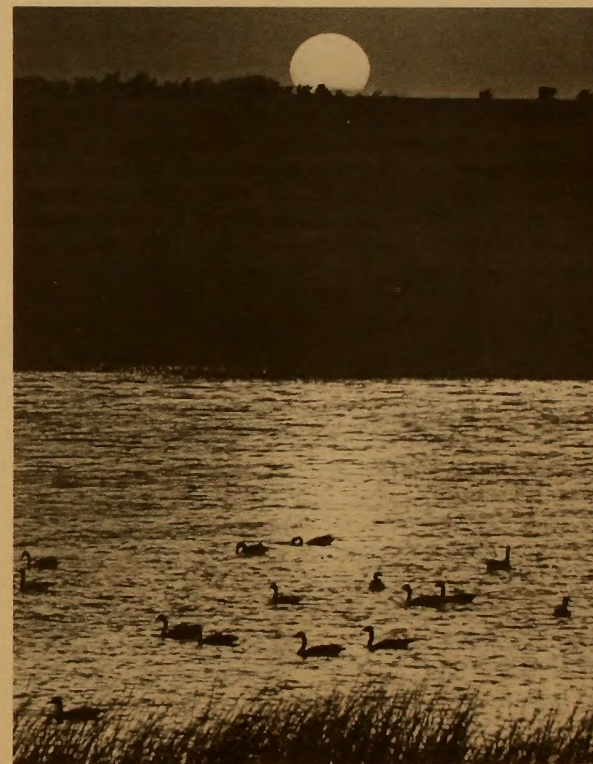
Mining and project siting for Level 1 would result in a loss of forage sufficient to support about 252 cows annually. Level 2 annual forage loss would support 280 cows annually. These potential losses could be anticipated throughout the project lifetimes.

The most significant impact, with regard to all levels of development, would be the destruction of habitat and complex vegetative communities, despite timely reclamation. Level 1 mining would disrupt 34,217 acres and Level 2 mining would disrupt 76,017 acres. Additional acreage would be disturbed for plant and ancillary facilities and transmission line and pipeline routings.

Present productivity, in terms of pounds of forage per acre, might be attained in three to five years through



Cattle dominate livestock production.



Some waterfowl production losses would occur.

reclamation with fast growing vegetation. However, declines in deer, upland game birds, numerous non-game birds, and some furbearers may be measurable for 20 years or more, depending upon the time needed to restore the forage quality, species diversity, and important shrubland and woodland types.

Impacts would vary between project areas, depending upon the type of habitat disturbed. The Level 3 sensitivity analysis indicates that the most important wildlife areas follow major drainages and that they are concentrated in Dunn and Mercer Counties, as shown on Map 6. Because of the large amount of preferred shrubland and woodland present in the Glenharold Mine area, the Washburn Mine area, and Federal Coal Study Areas S-5 and N-1A, mining would significantly affect local white-tailed deer, pheasant, and furbearer populations.

Level 1 development would cause waterfowl production losses amounting to about 360 young per year. This figure would at least triple when combined with the tentative projects, some of which are located in the pot-hole portions of McLean County. Mining in Federal Coal

Study Areas S-4A, S-4B, and N-1B would also affect waterfowl production. The losses would not measurably reduce waterfowl populations in the seven county study area, but could be significant locally. Duration of the losses would depend on land use decisions regarding wetland restoration.

Human population growth would add to the direct mortality of some species by hunting, poaching, and road kills.

Although the impact of particulate and trace element emissions cannot be predicted, it is possible that during the life of the projects, some measurable impacts on domestic animals and wildlife could occur.

Runoff and siltation could be expected to reduce the number of fish and aquatic invertebrates in surface water near mines, plant sites, and transmission line and pipeline rights-of-way, especially during construction periods.

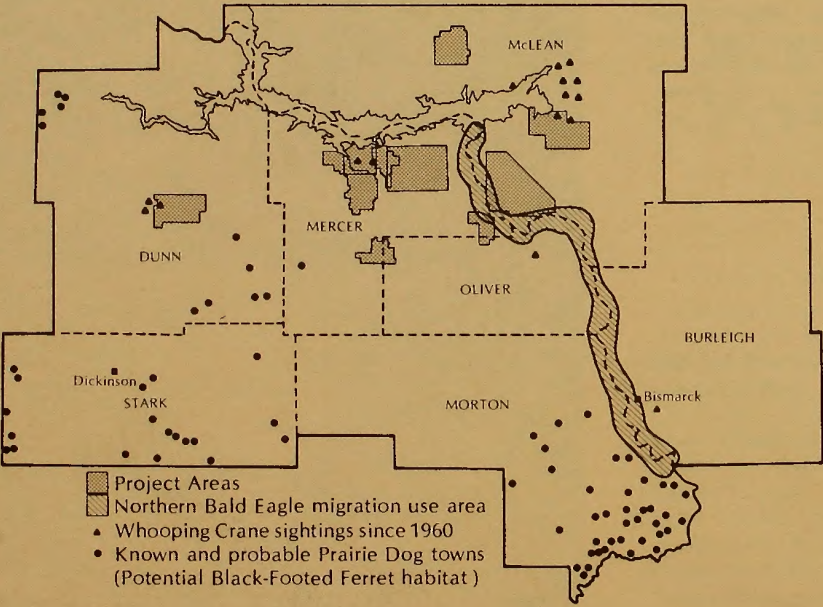
Major impacts on threatened or endangered species are not expected. However, prairie dog towns, potential

habitat of the black-footed ferret, could be disturbed, and transmission lines could result in fatal whooping crane collisions.

MITIGATING MEASURES

Successful reclamation of mined land would be the most important mitigating measure. Under both federal and state law, mining operators must restore the land to its approximate original topography and revegetate to the original land cover or landowner preference. The effectiveness of reclamation, with regard to animal habitat, would be directly proportional to the success in restoration of original vegetation, both in quantity and quality.

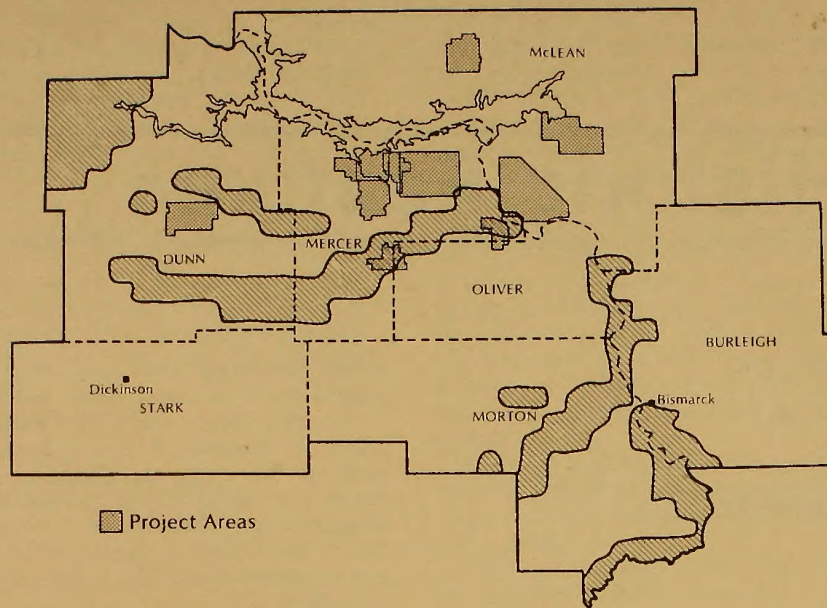
Reclamation problems with shrubland, wetland, and hardwood draws indicate that these habitat types should be avoided wherever possible. Reclamation suc-



MAP 5: THREATENED AND ENDANGERED SPECIES OCCURRENCE



Whooping cranes are occasionally sighted.



MAP 6: AREAS RATED HIGH FOR WILDLIFE POPULATIONS

cess in restoring self-perpetuating native woodland has yet to be proven. Both federal and state authorities are empowered to exclude unreclaimable land from mining.

Potential pollution would be partially mitigated through compliance with federal and state air and water standards. In addition, some applicants are committed to further reductions in pollutants through incorporation of various plant design features and equipment.

Monitoring programs could be developed to further study wildlife losses.

RESIDUAL IMPACTS

Rangeland removed from production by mining would cause a temporary reduction in the number of domestic grazing animals.

Big game, upland game birds, and some non-game birds would experience long-term reductions in population proportional to habitat loss as a result of mining

during Level 1. Losses could double or triple with mining during Level 2.

Waterfowl, furbearers, small mammals, reptiles, amphibians, raptors, and some invertebrates would experience initial population reductions due to habitat disruption. Successful reclamation would prevent any measurable long-term reductions.

Erosion, siltation, and airborne emissions could affect surface waters, fish, and aquatic invertebrates. Air pollution could possibly have some measurable impact on domestic animals and wildlife during the project lifetimes.

Human population growth would increase hunting pressure, poaching, and road kills.



A transmission line collision killed these geese.



Loss of habitat would reduce deer population.



Prehistoric and Historic Features

Prehistory refers to those sites dating to the time before written records were kept in North Dakota. History refers to those sites which can be associated with written records. The only detailed prehistoric and historic inventories in the seven county study area are concentrated where energy development is either imminent or ongoing.

To date, 450 prehistoric sites have been recorded in the area. These sites included earthlodge villages, quarries, stone circles, lithic scatters, rock art and arrangements, cairns and rock alignments, mounds, kill sites, campsites, caches, eagle traps, and burials.

Unknown historic features in uninventoried areas could be significant. Western North Dakota is identified with four major eras associated with exploration and fur trading, military activity and Indian removal, settlement, and, to a lesser extent, transportation to the gold fields of the West and the closing of the American frontier.

MAJOR IMPACTS

Many of the known prehistoric sites would be significantly impacted by the proposed action. Because no more than 13% of the seven county study area has been inventoried, it is not apparent what the impacts on known sites represent in terms of total possible sites. Figure 14 shows the number and type of known prehistoric sites and those that would be impacted. Because only project areas in Level 1 and portions of the Federal Coal Study Areas were inventoried, the data does not show impacts on prehistoric features in tentative project areas or Level 3 areas. However, impacts on prehistoric features in these areas may be similar.

More than 40% of the known quarries, stone circles,

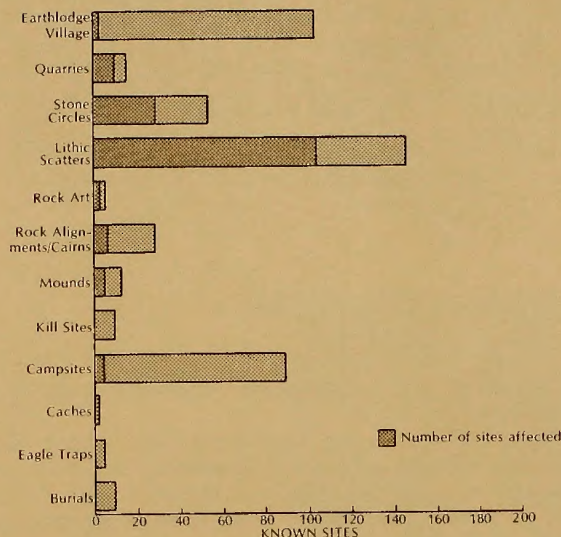


FIGURE 14: IMPACTS ON PREHISTORIC SITES

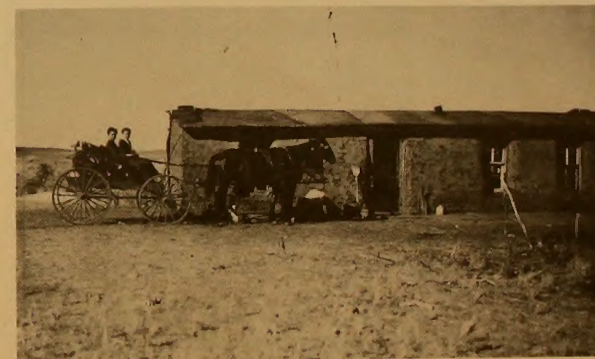
lithic scatters, rock art, and caches could be lost due to mining. Any impacts affecting earthlodge villages or mounds would be severe due to their scarcity and the amount of cultural information they contain. Big game kill sites and human burial sites are other significant prehistoric features.

Project areas in Level 1 contain 136 known prehistoric sites, of which 119 are located within the NGPL project area. All 136 sites would probably be directly affected by coal mining or plant and ancillary facility construction. Other impacts would occur due to amateur

artifact collecting and destruction of sites on land needed for expansion of urban and built-up uses.

The one known prehistoric earthlodge village that would be impacted by Level 1 development may be related to the ancestral Mandan, Hidatsa, or Arikara tribes. The village is located along the pipeline corridor associated with the Coyote 1 Power Plant. Additional Indian burials may be discovered when tentative project areas, Level 3 areas, and Federal Coal Study Areas are inventoried.

Historic features would also be destroyed by mining and construction of plants and ancillary facilities. Additional impacts would result from amateur artifact collecting and destruction of sites on land where urban and built-up uses are expanding. The few known historic sites likely to be impacted by projects in Level 1 include two German-Russian mud houses, two cemeteries, four or five early coal mines, one farmstead, and one historic burial. All of these sites are located on the ANG Coal Gasification Plant, Antelope Valley Power



This historic photo depicts the settlement era.

Plant, and Glenharold Mine project areas. These known sites may not represent all historic features because earlier inventories primarily emphasized prehistoric features. Since these inventories did not adequately document historic features in the seven county study area, Table 3 suggests the probable occurrence of sites by historic era in the vicinity of the project areas. The probable occurrence of historic sites is greatest in the Glenharold Mine project area. Tentative project areas and Level 3 areas have not been inventoried for historic features. Impacts comparable to Level 1 would likely occur as a result of mining, plant and ancillary facility construction, collecting by amateurs, and expansion of urban and built-up uses.

**TABLE 3
PROBABLE OCCURRENCE OF
HISTORIC FEATURES**

Level 1 Project	Proto-historic Indian Era	Fur Trade/ Exploration Era	Military/ Indian Removal Era	Settlement Era
Coyote 1	High	Low	Low	High
ANG	High	Low	Low	High
Antelope Valley	High	Low	Low	High
NGPL	High	Low	Medium	High
Glenharold Mine	High	High	High	High

MITIGATING MEASURES

Federal and state legislation requires governments and applicants to implement measures to protect prehistoric and historic features. These mitigating measures would require inventories to locate and evaluate sites on project areas. Measures associated with site evaluation would include excavation, testing, mapping, collection of artifacts, and possible preservation through nomination to the National Register of Historic Places.

The 13 most critical sites on the project areas of Level 1 are now under consideration for nomination to

the National Register of Historic Places. A total of 30 moderately important sites in these areas should be recommended for test excavation. In addition, 82 sites should be mapped and artifacts should be collected. Recommended mitigating measures for six sites have been withheld pending further study, while no measures were needed for the remaining five.

Many of the prehistoric and historic sites in the Federal Coal Study Areas are the same as those identified in Level 1 areas. However, mitigating measures should be recommended for 23 additional prehistoric and historic sites located in Federal Coal Study Areas. One site has been chosen for nomination to the National Register of Historic Places. The remaining 22 sites should be recommended for test excavation, artifact collection, or mapping.

Mitigating measures for Level 1, 2, and 3 areas and Federal Coal Study Areas not yet examined would include inventory, evaluation, and protection or preservation of sites.

Additional impacts, such as amateur artifact collecting and destruction of sites due to urban and built-up expansion, are not covered by enforceable measures but could be reduced by surveillance, fencing, or burying. Inventories should be conducted where community expansion is planned and identified sites should be avoided.



Carl Bodmer's painting of Fort Clark in 1833.



Excavation of an Indian village.

RESIDUAL IMPACTS

Mitigating measures applied to known historic and prehistoric sites in project areas and Federal Coal Study Areas would not preserve many sites in their entirety. They would preserve some of the information that the sites contain, but more information would probably be lost than saved. Archaeological methods are not advanced enough to assure that all information can be collected via excavation.

Thirteen sites in project areas in Level 1 would be either preserved or totally excavated as a result of nomination to the National Register of Historic Places, thus saving in one form or another the information they contain. Test excavation would preserve only a portion of the information in those 30 sites recommended for evaluation. All subsurface information would be lost on the 82 sites recommended for mapping and collection only. Cultural information would be lost from those sites for which no mitigating measures were recommended.

One site in the Federal Coal Study Areas would be either preserved or totally excavated as a result of nomination to the National Register of Historic Places. Only a portion of the information contained in the 22 sites recommended for test excavation, artifact collection, or mapping would be preserved.

When prehistoric and historic sites are identified in tentative project areas and Level 3 areas, residual impacts would be similar to those for known sites.



Aesthetics

Aesthetics is the study of beauty of the environment as perceived through the senses of sight, hearing, smell, taste, and touch. Because sight, hearing, and smell are the dominant senses, the analysis of aesthetic impacts in the seven county study area is limited to visual resources, sound, and odors.

The plains landscape, interrupted by scattered buttes, is the most common scenery type. Scenic areas are those with unusual topographic features such as the Little Missouri River Badlands and Killdeer Mountains, or those with a water orientation, such as the Missouri River, Lake Sakakawea, and Lake Ilo.

Existing sound levels are those of a quiet rural environment. Primary sound sources include agricultural equipment, cattle, wind, insects, automobile traffic, and the normal spectrum of sounds associated with small rural communities.

Odors in the seven county study area include those of livestock, dust, agricultural chemicals, petroleum distillates, and machinery operation. In areas of mining activity, odors from dust, petroleum distillates, machinery, and certain volatiles of coal may be detected.

MAJOR IMPACTS

Visual impacts would result from incompatible structures and land surface disturbances. Land surface disturbances would include clearing and grading of the land for building purposes and roads, as well as stockpiling of coal, topsoil, and spoil material.

The most severe visual impacts would occur at the energy conversion facility sites. Buildings and other structures would be noticeable for distances of up to 20

miles, particularly the plant emissions stacks which stand as high as 30 stories. Distance would minimize the adverse visual impacts, with the most severe impacts occurring within five miles of the site.

Ancillary plant facilities would also visually affect the local area. Pipeline and electrical transmission line construction, transmission line towers, pipeline pumping stations, and water intake structures would all adversely impact the landscape. Figure 15 shows the visual impacts of a transmission line.

Adverse visual impacts associated with mining would

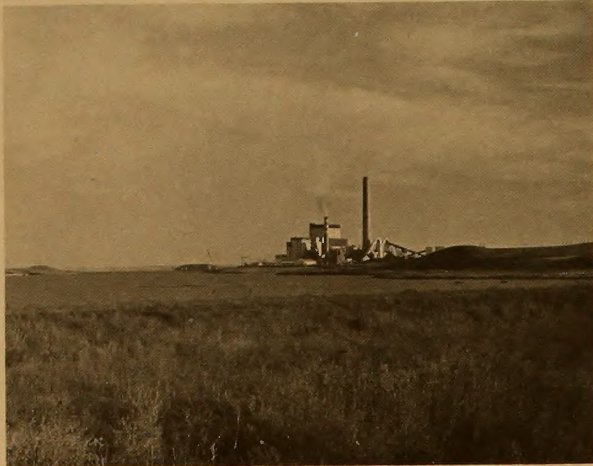
include the appearance of draglines and spoil piles against the skyline, and dust generated by the mine tippie, haul road traffic, and blasting activity. Mining would also result in the loss of aesthetically appealing native prairie.

Locations of high visual concern are found throughout all of the Level 3 areas. These locations comprise 60% or more of most Level 3 areas, with the exception of the New Salem and North Beulah-Hazen areas, where they account for only about 25%.

Significantly increased sound levels would occur



FIGURE 15: VISUAL IMPACT OF TRANSMISSION LINES



Plant facilities would be noticeable for distances of up to 20 miles.

within at least three miles of all Level 1 and tentative project areas. Table 4 lists sound sensitive locations within three miles of the project sites in Level 1. These sound level increases would be highest during construction of the conversion facilities, mine, pipelines, and transmission lines, with some reduction expected once facilities are operational.

These higher sound levels may cause annoyance, interfere with hearing and speech communication, interfere with sleep, reduce property values, and disturb wildlife.

Specific areas which may experience increased sound levels because of the tentative projects include Beaver Creek and Hille State Game Management Areas, Audubon National Wildlife Refuge, the Missouri River, and the communities of Garrison, Underwood, and Washburn.

Two national wildlife refuges and eight game management areas could also be affected by higher sound levels due to mining and other energy related activity in Level 3 areas and Federal Coal Study Areas.

Detectable odors would be produced primarily by the energy conversion facilities. The ANG and NGPL Coal



Transmission towers dominate this landscape.

Gasification Plants would produce sulfur dioxide, and possibly hydrogen sulfide, at noticeable levels. Only sulfur dioxide would be detectable at the Antelope Valley and Coyote 1 and 2 Power Plants. These odors would be localized, generally affecting only plant em-

TABLE 4
LEVEL 1 SOUND SENSITIVE AREAS

Level 1 Project	Sound Sensitive Area	Approximate Distance
Coyote 1	Beulah	3 miles
ANG	Zap	3 miles
Antelope Valley	Zap	3 miles
NGPL	Dunn Center	3 miles
	Lake Ilo	3 miles
Glenharold Mine	Stanton	1.5 miles

ployees or visitors. They would normally dissipate within two miles of the plants, although odors may occasionally be noticed at greater distances. Mining would produce minimal odor levels which would be dissipated by wind and distance.

MITIGATING MEASURES

Mitigating measures for Levels 1, 2, and 3 and Federal Coal Study Areas are similar. Visual impacts due to mining disturbance of land would be reduced through



Badlands are characterized by unusual topographic features.

enforcement of the federal and state reclamation law. The North Dakota siting law for energy conversion and transmission facilities requires a buffer zone around aesthetically important or sensitive areas. The applicants must meet federal and state noise control standards and impacts associated with plant odors would be mitigated through compliance with federal and state air quality regulations.

Federal, state, and county authorities could attach permit conditions to reduce visual, sound, and odor impacts. These measures could include blending plant facilities into the landscape through the use of low-profile buildings and non-reflective green, brown, or buff colored paints; establishing monitoring programs at sound sensitive locations; and confining vegetative clearing within transmission line or other rights-of-way to the actual construction locations.

Important non-enforceable mitigating measures would include minimizing land surface disturbances and construction of landscaped berms to partially shield visual impacts, as shown in Figure 16. The former measure could be accomplished through reductions in project size and use of road, railroad, and right-of-way alignments already part of the existing landscape. Where agricultural patterns occur, linear features, such as transmission lines or pipelines, could parallel field edges.

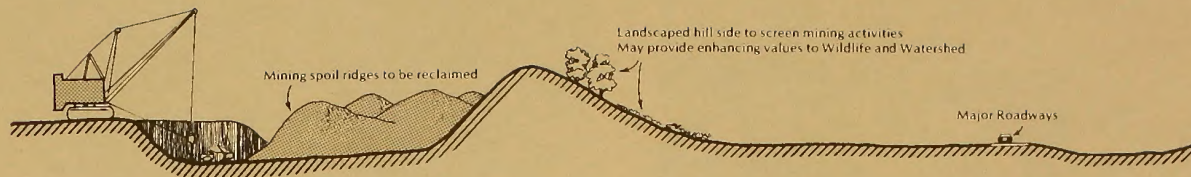


FIGURE 16: SCREENING OF MINING ACTIVITY

RESIDUAL IMPACTS

Despite application of the preceding mitigating measures, the visual impacts of emission stacks, bulky plant facilities, draglines, spoil banks, and transmission line towers would be evident on the landscape.

The aesthetic appeal of native prairie would be diminished where reclaimed to a less diverse cover.

Areas within approximately three miles of energy conversion and mine sites would experience increased sound levels. Minor sound level increases would be detected beyond three miles. Although not considered a serious health hazard, heightened sound levels may cause annoyance, interfere with hearing and speech communication, interfere with sleep, reduce property values, and disrupt wildlife.



View from the Killdeer Mountains.



Recreation

Popular outdoor recreation activities in the seven county study area include swimming (at community pools), picnicking, fishing, camping, snowmobiling, baseball, softball, and ice skating. Fast-growing activities include camping, golf, tennis, and waterfowl hunting.

Outdoor recreation areas in the seven county study area include national wildlife refuges; federal, state, and local parks and recreation areas; state game manage-

ment areas; and private recreation areas. Lake Sakakawea is a particularly important recreation area.

Special interest areas include potential state nature preserves; waterfowl production areas; state lands with high recreation potential; buttes, badlands, and recreation environments associated with Lake Sakakawea; the Missouri River; and the pothole region of McLean County.

MAJOR IMPACTS

The proposed action would impact recreation primarily because of mining or plant site facility land disturbance, the sights and sound of mining and conversion facility operation, and changes in the population growth rate and composition. The most significant impacts would be due to population change.

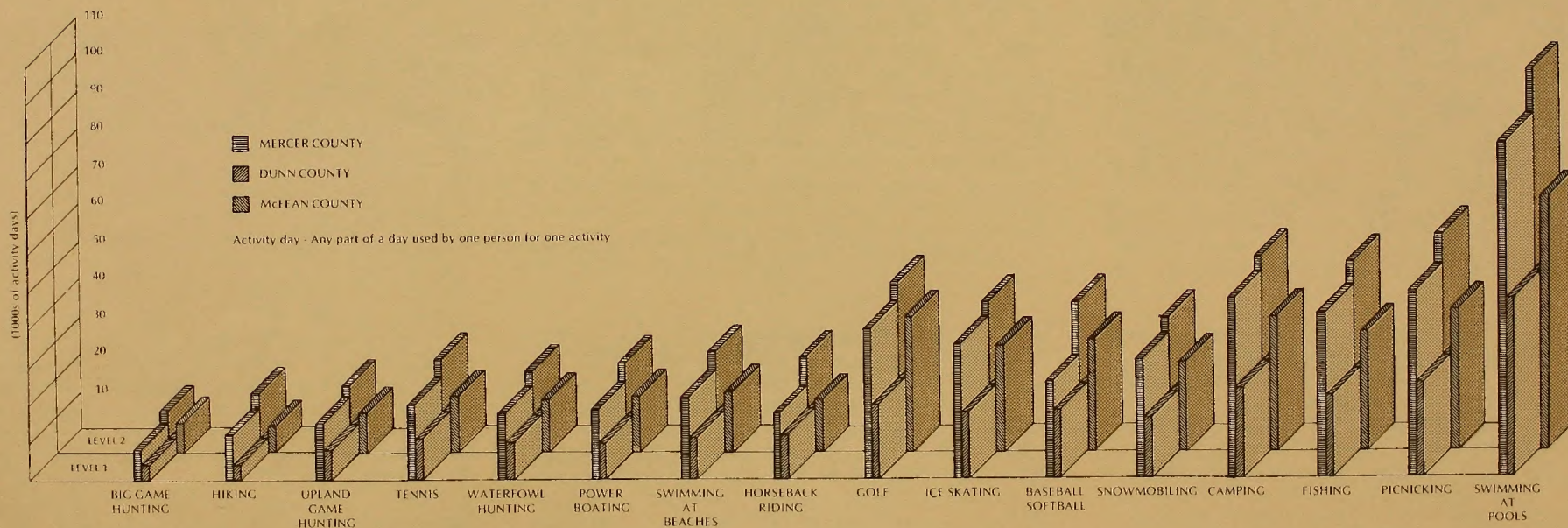


FIGURE 17: PEAK TOTAL RECREATION ACTIVITY DAYS — 1985

Participation in outdoor recreation activities in Dunn and Mercer Counties would approximately double as a result of the increased population associated with Level 1 development. Population growth associated with the tentative projects would result in greater outdoor recreation activity primarily in McLean and Mercer Counties. Figure 17 presents 1985 Level 1 and 2 outdoor recreation activity days for residents of Dunn, McLean, and Mercer Counties. Among facility-oriented recreation, swimming (at community pools), camping, picnicking, and golf would show the largest growth.

Among resource-oriented recreation activities, hunting and fishing would exhibit the greatest increase in activity days. However, increases in fishing could be limited because of poor access roads and inadequate



Rodeos are popular on the Fort Berthold Reservation.

launching facilities. Hunter-landowner conflicts would lead to more posting of private land, with consequent pressure on public hunting areas and frequent instances of trespass and vandalism.

The most significant needs for new outdoor recreation facilities with Level 1 development would occur in Dunn and Mercer Counties, especially in the communities of Beulah, Hazen, and Killdeer. Population increases as a result of the tentative projects would generate the need for additional outdoor recreation facilities in McLean and Mercer Counties. Figure 18 depicts projected outdoor recreation facility needs by 1984 as a

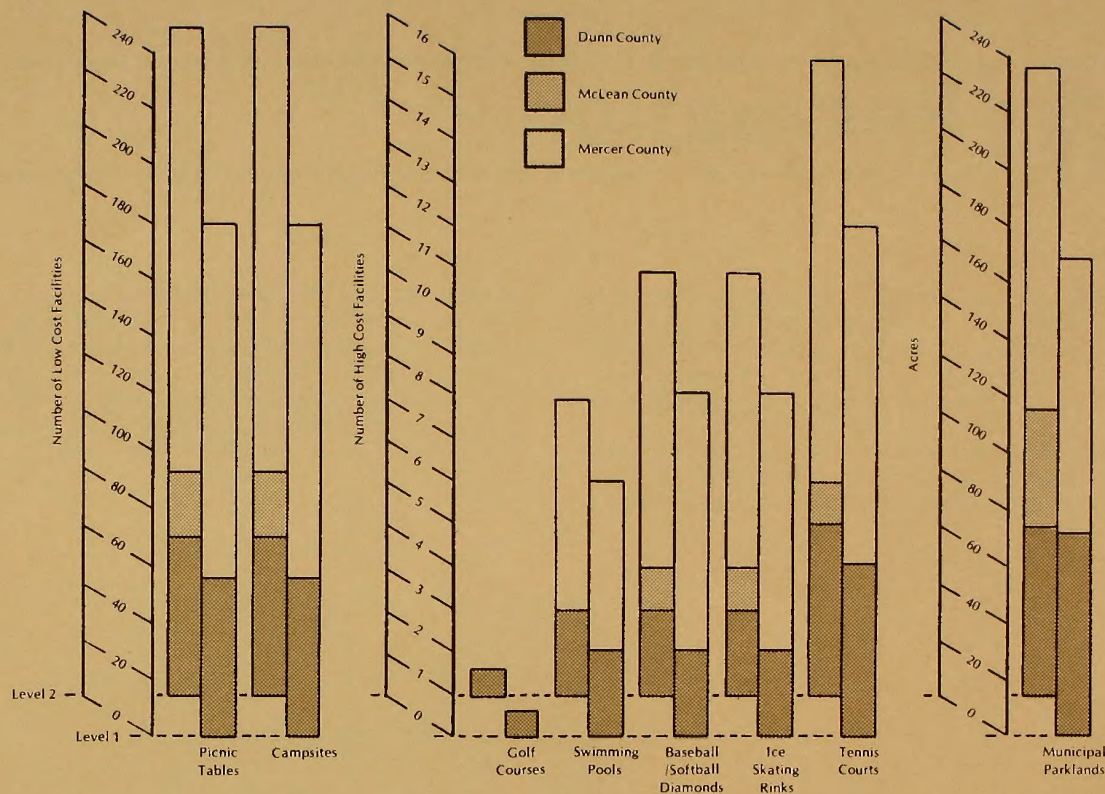


FIGURE 18: PEAK OUTDOOR RECREATION NEEDS DUE TO POPULATION INCREASE — 1984

result of Level 1 and 2 development.

Outdoor recreation areas expecting the greatest use with Level 1 and 2 development would include Lake Ilo National Wildlife Refuge, four Corps of Engineers Recreation Areas (Downstream, Tailrace, Wolf Creek, and Totten Trail), Hazen Bay and Beulah Bay Recreation Areas, and nine game management areas (Beaver Creek, de Trobriand, Douglas Creek, Hille, Killdeer, Lake Audubon, North Beulah, Riverdale, and Wolf Creek). These areas would experience overcrowding, vandalism, litter, vegetative damage, and higher administrative and enforcement costs.

Outdoor recreation areas which could be affected by Level 3 development include one state park, three national wildlife refuges, five state game management areas, five waterfowl production areas, several local and private recreation areas, five potential state nature preserves, and seven tracts of state land with recreation potential.

Mining in Federal Coal Study Areas S-1, N-1A, and N-2A, all lying near the southern shore of Lake Sakakawea, would significantly affect nearby outdoor recreation areas. Mining of Federal Coal Study Area S-3 would affect portions of the Missouri River breaks.

The need for indoor recreation facilities such as gymnasiums, recreation centers, bowling alleys, and senior citizen centers, would be greatest in the communities of Beulah, Hazen, and Killdeer with Level 1 development. Tentative mine projects in McLean County would require additional indoor recreation facilities in the communities of Garrison, Underwood, and Washburn.

Although no state nature preserves have yet been designated in North Dakota, several Dunn County sites now under consideration would be affected by the NGPL Coal Gasification Plant. These sites include Horse Nose Butte, Ziner Butte, and the Lost Bridge Badlands. No potential state nature preserves lie within tentative project areas.

The Fort Berthold Reservation would experience a substantial increase in recreation activity due to Level 1 and 2 development. There would be a noticeable disruption of the isolated environment that reservation residents now enjoy due to more vandalism, fence damage, livestock disturbance, trespassing, and illegal hunting.

The Fort Berthold Reservation may benefit from new

recreation and tourist trade at the Four Bears Recreation Complex.

MITIGATING MEASURES

Mitigating measures for Levels 1, 2, and 3 and Federal Coal Study Areas would be similar. Applicants' compliance with state and federal reclamation laws would insure that impacts to recreation are minimized. Mining would be prohibited in areas where recreational values would be permanently destroyed. State law forbids energy conversion and transmission facility siting on federal, state, or local recreation areas, wildlife refuges, game management areas, hardwood draws, or unique natural areas. State law also requires a buffer zone of reasonable width to protect the integrity of these areas. A three mile buffer zone around major recreation resources would mitigate nearly all impacts due to mining disturbance.

The majority of mitigating measures which could be directed at alleviating population related impacts are unenforceable under existing law. Because the significant recreation resource impacts would be associated with increased demand and use, these mitigating measures are aimed at adding facilities, preventing crowding, and controlling existing and projected use. Federal and state grant programs and applicant donations of money, land, manpower, or equipment would assist in the construction or improvement of facilities. Measures to control recreation overuse could include extension of seasonal use periods as well as limitations on visitor capacities and lengths of stay at specific locations.

RESIDUAL IMPACTS

The most significant residual impact, due to Level 1 and 2 development, would be the increased use of all outdoor recreation areas and facilities as a result of population growth. This growth in demand may diminish the quality of recreation experiences because of overcrowding, vandalism, litter, vegetative trampling, increased administrative and enforcement costs, and changes in the primitive characteristics of some recreation areas.



Visitor capacity limits could control recreation overcrowding.

The Dunn and Mercer County communities of Beulah, Hazen, and Killdeer would need new parklands and outdoor and indoor recreation facilities with Level 1 development. The tentative projects would require similar facilities in Garrison, Underwood, and Washburn in McLean County. Community swimming pools, picnic sites, camping sites, golf courses, softball diamonds, ice skating rinks, and tennis courts are among the outdoor facilities most needed. Indoor recreation facility needs would include gymnasiums, recreation centers, bowling alleys, and senior citizen centers. Non-community recreation areas and resources experiencing greater use would include the Missouri River; the badlands in northern Dunn County; the pothole region of McLean County; and the state parks, game management areas, and designated recreation areas along Lake Sakakawea's shoreline.

Although none of the project areas include designated recreation or natural areas, the NGPL Coal Gasification Plant would affect three potential state nature preserves.

Increased hunting pressure and decreased hunter satisfaction would not be fully mitigated by any changes in season length or license restrictions. Greater public use of private land could cause additional posting of such land, resulting in more use of public lands.

Recreation expansion on the Fort Berthold Reservation would cause increased vandalism, unauthorized trespass, and a change in the isolated nature of the reservation environment.



Increased hunting would lead to more posting of private land.



Economic Conditions

Agriculture is the dominant industry in the seven county study area. Although employment in the agricultural sector has historically declined, energy related employment has grown dramatically. Despite employment growth during the 1970s, the area has experienced a higher average rate of unemployment than the state as a whole.

Population in the seven county study area increased during the period from 1940 to 1970, but not as rapidly as the rate of growth since 1970. With the exception of Dunn County, all of the seven counties have experienced population increases since 1970. Burleigh County, which includes the city of Bismarck, grew faster than any of the other counties.

Area city and county governments, as well as school districts, rely heavily on property taxes as a source of operating revenue. However, the dependence of local government on the property tax is declining because this tax base has not kept pace with expenditures. A growing reliance on federal and state funding is now evident.

Revenues needed to finance state government services in North Dakota are primarily derived through a diversified state tax system which emphasizes sales and income taxes as the primary source of general fund revenues.

MAJOR IMPACTS

Level 1 and 2 development would generate new business activity primarily in the construction, household, retail trade, and service sectors. During the period from 1976 to 1999, Level 1 business activity would increase

by \$3.3 billion. Level 2 business activity would increase by \$4.2 billion over the same period.

Total seven county employment forecasts are presented in Figure 19. Additional employment as a result of Level 1 development would peak in 1981 with over 10,000 jobs, while Level 2 employment would peak at 11,000 jobs in 1983. Employment increases would be

greatest in Dunn, McLean, and Mercer Counties. Figure 19 shows total employment in these counties.

Efforts to hire local residents would reduce seasonal and long-term unemployment and increase female and Indian labor participation rates. Because energy project wages are typically higher than existing jobs in the area, the standard of living for worker families would probably improve.

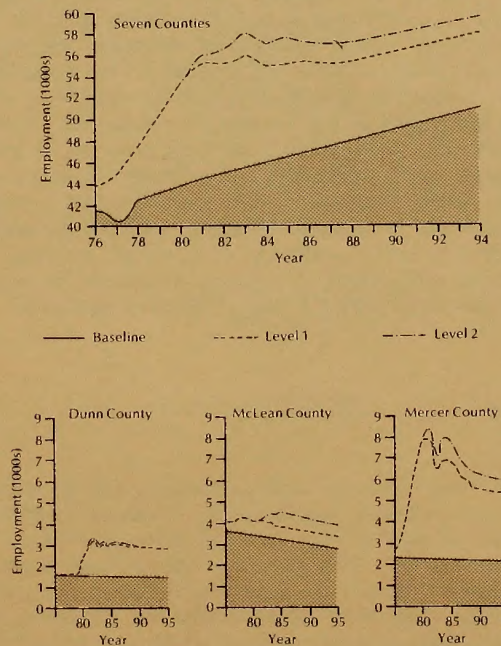


FIGURE 19: EMPLOYMENT PROJECTIONS

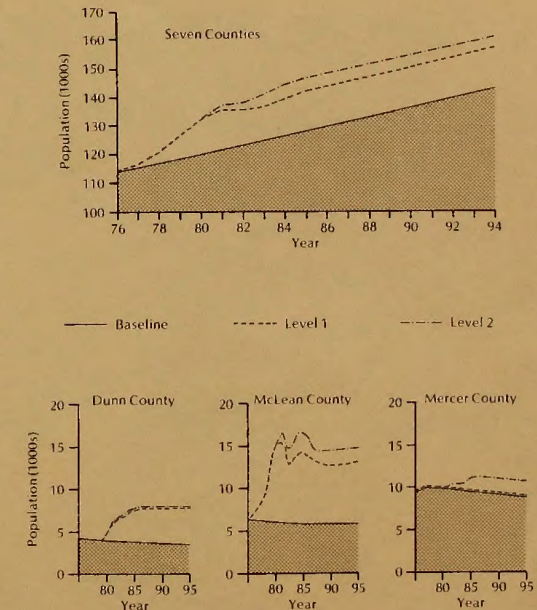
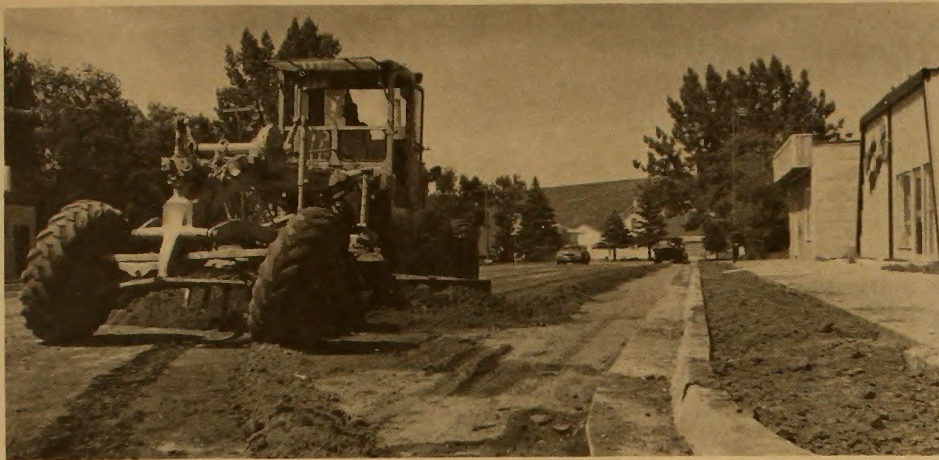


FIGURE 20: POPULATION PROJECTIONS



The paving of Zap's Main Street was partially funded by the Coal Impact Office.

Total population in the seven county study area with Level 1 and 2 development is shown in Figure 20. New population from Level 1 development would peak at 15,000 in 1986, thereafter stabilizing near 14,000 during the operation phase. Level 2 new population would peak in 1985 at about 19,000 before stabilizing at about 18,000 during operation.

Level 1 population growth would be greatest in Dunn and Mercer Counties. Population increases with Level 2 would be concentrated in Dunn, McLean, and Mercer Counties. Figure 20 shows population for these counties. Level 1 population growth would be greatest in the communities of Beulah, Hazen, and Killdeer. Most of the population increase attributable to the tentative projects would occur in Beulah, Garrison, Hazen, Underwood, and Washburn.

Population impacts on the Fort Berthold Reservation would include Indian population movement from other segments of the reservation to the south segment.

Total personal income in the seven county study area is projected to be 20% greater in 1980 with Level 1 development and would average about 7 to 10% greater than baseline throughout the operation phase. Level 2 personal income would be 31% greater in 1983, finally stabilizing at a 10% increase over baseline during operation. Per capita income is projected to grow only slightly with Levels 1 and 2 because of the high number of non-working dependents.

The rapid growth in population resulting from Level 1

and 2 development would create burdensome demands for public services. During the construction phase, local governments would encounter difficulty in timely financing and managing the expansion of public services and facilities. State expenditures would increase during this same period. In both cases, revenues needed to finance increased costs would not be available until after the projects are operational.

Impacts on local finances would be especially severe in Dunn, McLean, and Mercer Counties. Figure 21 displays Level 1 and 2 net fiscal balances for these counties. Net fiscal balances for impacted cities and school districts in the seven counties are shown in Figure 22.

State costs and revenues would increase because of the proposed action. Table 5 illustrates that the increase in annual state expenditures would exceed revenues until coal conversion and severance tax monies become available.

Impacts associated with Level 3 and Federal Coal

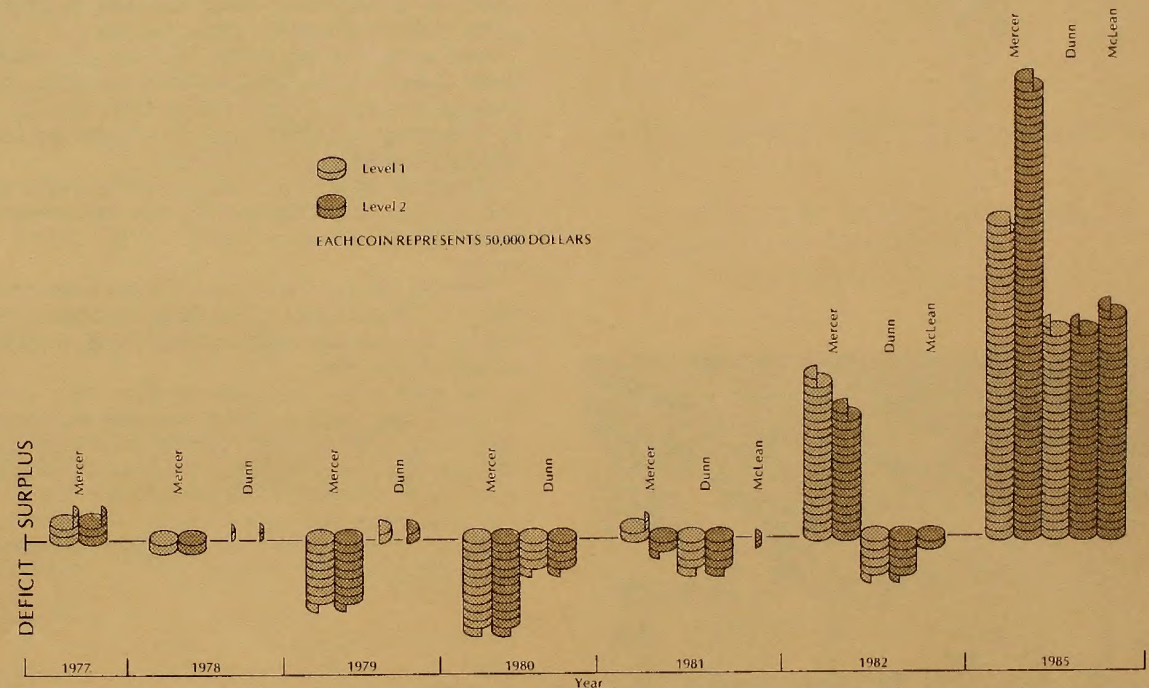


FIGURE 21: ANNUAL NET FISCAL BALANCES FOR IMPACTED COUNTIES

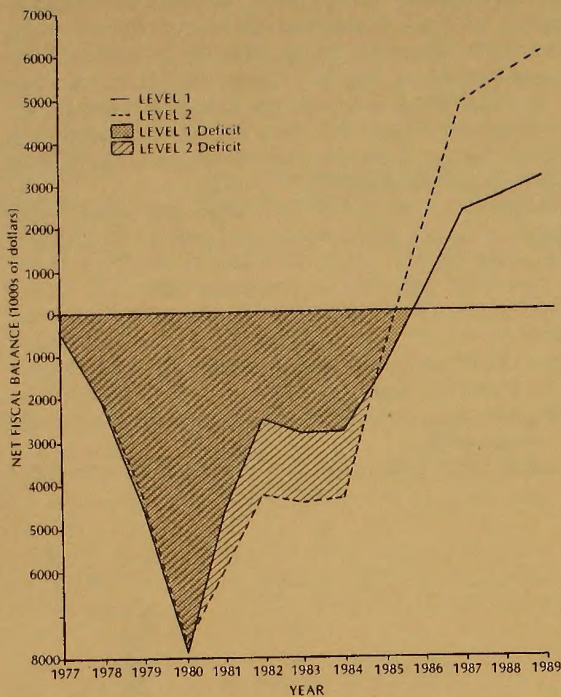


FIGURE 22: NET FISCAL BALANCES
FOR IMPACTED CITIES AND
SCHOOL DISTRICTS



Economic activity in the construction sector would grow.

Study Areas would be similar to Levels 1 and 2. However, it is possible that new Level 3 development could use any excess public service capacity or labor supplies still remaining from prior energy growth.

MITIGATING MEASURES

A commitment by the applicants to employ as many local residents as possible would be the single most important mitigating measure. In addition, compliance with the Equal Employment Opportunity program would insure that women and minorities are given serious consideration for jobs. Both measures would reduce the population influx.

State law directs the Coal Impact Office to aid impacted political subdivisions with coal severance tax revenues. Coal Impact Office funds from existing and new coal development would be used to mitigate impacts associated with the proposed action.

The North Dakota Public Service Commission or North Dakota Water Commission could phase the issuance of permits for active and tentative projects, thereby mitigating economic impacts through reductions in population growth.

Conditions attached to siting permits, water permits, and county conditional use permits could require the applicants to absorb a portion of the public service costs.

Training programs sponsored by governmental agencies, the United Tribes Educational Technical Center, or energy companies could qualify local residents for energy related jobs.

The state coal conversion tax rates could be altered to insure that revenues would escalate with public service costs. The synthetic gas tax payments could be changed from an annual to a quarterly basis to provide more timely distribution to local entities.

A tribal motor pool or bus system, serving the energy sites, would make jobs more accessible to residents of the Fort Berthold Reservation.



Energy development has rapidly changed Hazen's Main Street.

TABLE 5
STATE NET FISCAL BALANCE¹

Year	Level 1	Level 2
1977	+ 364	+ 364
1978	- 242	- 242
1979	- 1,818	- 1,815
1980	- 3,973	- 3,963
1981	+ 886	+ 89
1982	+ 4,585	+ 6,250
1985	+ 3,291	+ 15,569

¹ In thousands of dollars, inflated by 7% annually to estimate value in year shown.

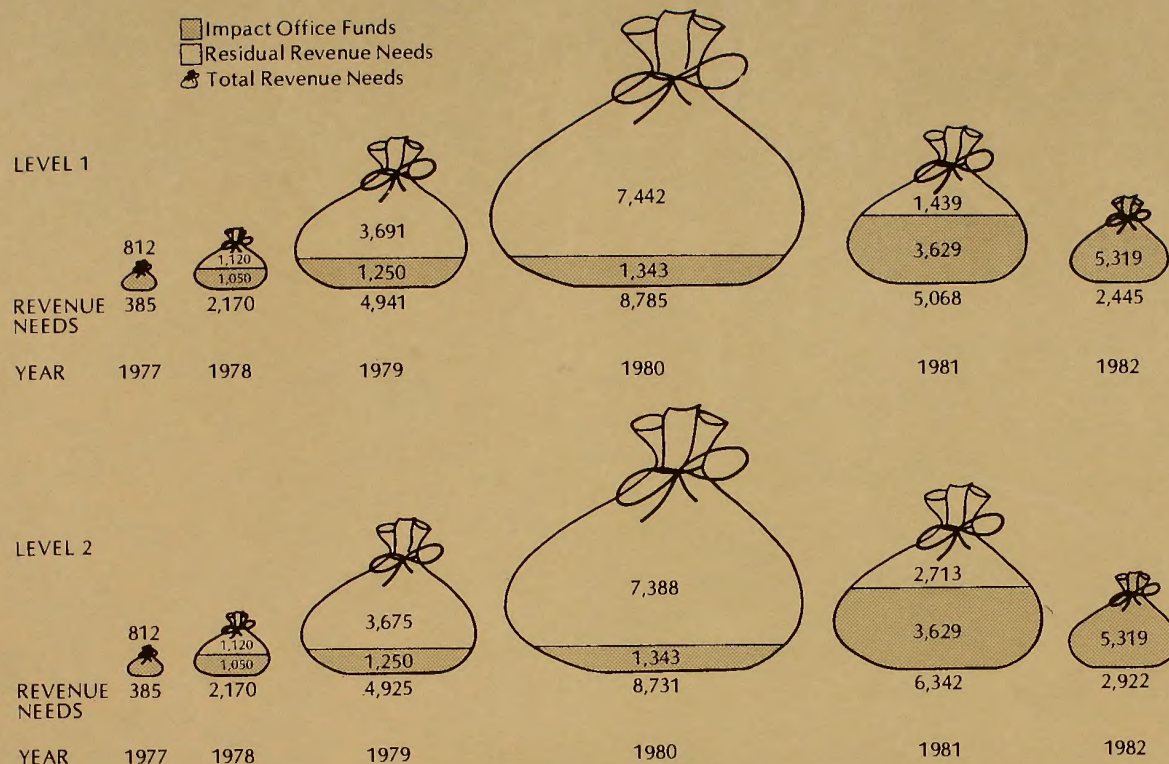


FIGURE 23: COUNTY, CITY, AND SCHOOL DISTRICT REVENUE NEEDS (1,000s of dollars)

RESIDUAL IMPACTS

Business activity would increase by \$3.3 billion with Level 1 development and \$4.2 billion with Level 2 development.

Level 1 employment would peak at 10,000 new jobs while Level 2 employment would peak at 11,000 new jobs. It is unlikely that local hiring would completely eliminate labor in-migration, particularly where highly specialized workers are needed. However, hiring local residents would reduce unemployment and increase female and Indian labor participation rates.

Population increase would depend upon the number of new workers migrating to the seven counties. Level 1 and 2 new population would peak at 15,000 and 19,000, respectively.

Total personal income during the operation phase would increase 7 to 10% over baseline with Level 1 development and 10% with Level 2 development. Per capita income would grow only slightly.

The high degree of uncertainty regarding mitigation of local government finance needs indicates that those not covered by Coal Impact Office funds would remain as residual impacts. Projected residual revenue needs for counties, cities, and school districts are shown in

Figure 23.

State expenditures related to Levels 1 and 2 would exceed revenues until 1981. At that time, coal conversion and severance revenues from new energy production would exceed state expenditures.



Social Conditions

A recent survey measured how residents of Dunn, McLean, Mercer, and Oliver Counties perceive their communities with and without new energy development. Most persons foresee little change in their social environment if coal development does not proceed. With the exception of higher tax and crime rates, they expect their present rural lifestyle to continue.

With energy development, however, the picture changes radically. Residents foresee dramatic improvement in employment opportunities and income levels in the next 1 to 3 years. Additional improvements in medical care, social services, and recreation and education facilities are anticipated over the next 30 years. Residents anticipate that air quality, crime, and taxes would substantially worsen in the future with energy development. However, only air quality deterioration appears to be directly attributable to energy development, while crime and tax rates are expected to worsen with or without energy development.



Beulah is already the scene of new housing construction.

MAJOR IMPACTS

Level 1 development would result in major changes in the social environment of Dunn and Mercer Counties. Impacts would be most evident and severe during the construction phase. Social impacts stemming from the development associated with the tentative projects would occur primarily in McLean and Mercer Counties.

Mental health problems would be more visible due to large numbers of persons living in crowded and strained conditions.

Mining during Level 1 would result in 20 fatalities and about 1,370 non-fatal injuries over the approximate 30-year mine lifetimes. Conversion facilities in Level 1 would result in about 1,200 plant-related injuries during the operational period. Cumulative mining activity for Level 2 would account for 33 fatalities and 2,281 non-fatal injuries. Plant-related injuries for Level 2 would

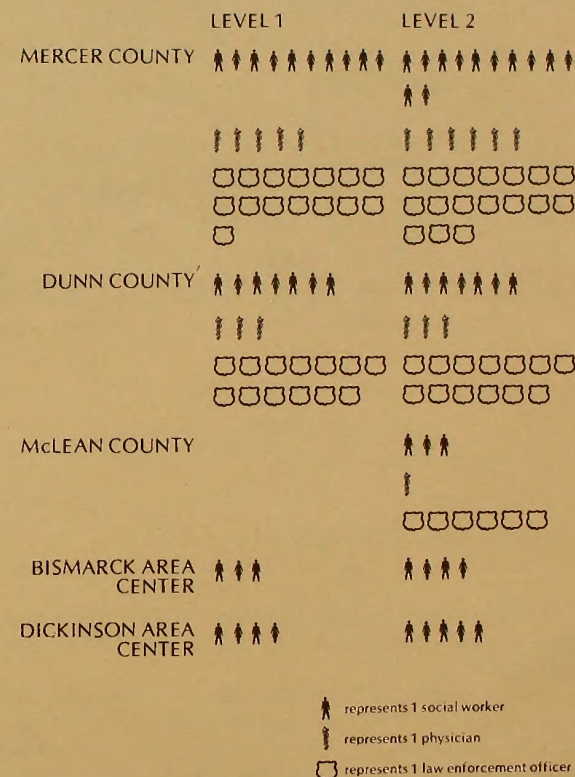
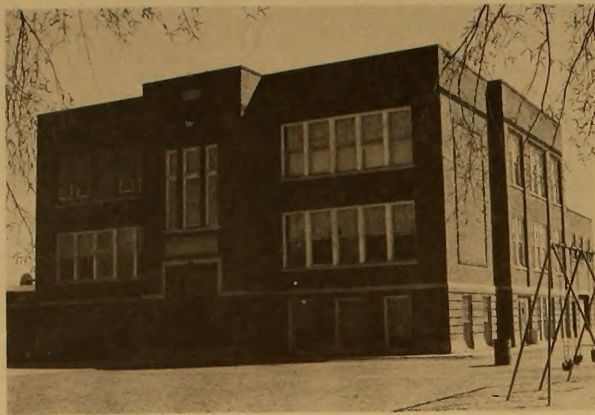


FIGURE 24: SERVICE PERSONNEL NEEDS



The Hazen School District would require expanded facilities.

total about 1,232.

Communities in Dunn, McLean, and Mercer Counties would experience shortages of physicians. Figure 24 shows additional physicians required in these counties as a result of Level 1 and 2 development. These communities would probably experience difficulty in attracting the physicians needed, especially during the construction phase.

Hospitals, addiction treatment centers, public health districts, and ambulance services would be impacted, particularly in Dunn, McLean, and Mercer Counties. A total of 58 hospital beds would be required due to Level 1 population increases, while 73 beds would be necessary for Level 2. Hospitals with low occupancy rates within 50 miles of Level 1 and 2 population centers in Dunn, McLean, and Mercer Counties may provide these beds.

The family structures of both existing residents and newcomers would be altered as employment opportunities for women expand, relationships between parents and children become more segmented, and the number of divorces increase.

The incidence of child abuse and neglect would likely grow, based on rates in other communities experiencing rapid growth due to energy development. Contributing factors include long working hours, crowded living conditions, lack of day care centers, and separation from extended family members and friends. Child abuse and neglect would require child protection services, foster care, and day care centers, particularly in Dunn, McLean, and Mercer Counties. The need for day care

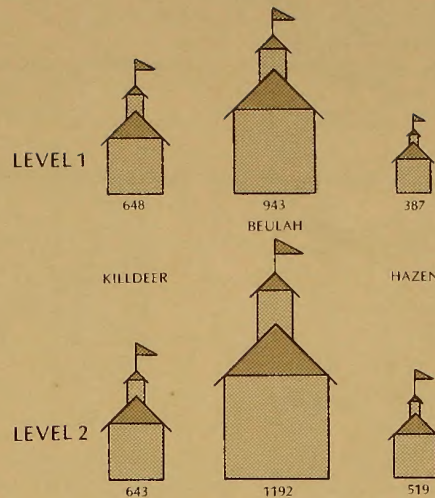


FIGURE 25: INCREASE IN STUDENT ENROLLMENT—1984



Cultural changes would affect Fort Berthold.

centers would also grow because of new job opportunities for women outside the home.

Social service organization caseloads in Dunn, McLean, and Mercer Counties would grow, necessitating additional staff at both the county and area levels of service, as shown in Figure 24.

The crime rate could be expected to accelerate during the 1978-87 period of rapid population growth, especially in Dunn, McLean, and Mercer Counties. The greater incidence of traffic offenses, violent crimes, prostitution, and gambling would generate the need for additional law enforcement manpower. Figure 24 portrays law enforcement personnel needed with Levels 1 and 2.

Level 1 school enrollment increases in the seven counties would peak at approximately 2,700 students. With cumulative Level 2 development, the school enrollment increase would be about 3,500 students. Figure 25 shows additional students in 1984 for those school districts anticipating substantial expansion and possible shortages of classroom space.

Larger school enrollments and differences in expectations of the in-migrating population and the long term residents may result in a wider variety of course offerings and additional support services.

In-migrating construction, operation, and indirect workers would prefer different types of housing units, as shown in Figure 26. Mobile homes would dominate during the construction years. However, after 1987, the number of mobile homes would decrease due to operation and indirect worker preferences for single family units.

The housing demand attributable to Level 1 development would peak at roughly 4,200 units in 1982 and stabilize at 3,500 units by 1988. Level 2 housing demand would peak at approximately 5,000 units in 1985 and stabilize at roughly 4,500 units by 1988. Figure 26 shows peak housing needs in the communities of Beulah, Hazen, and Killdeer where population growth would be greatest. Individuals living on fixed incomes could be severely impacted as a result of housing shortages and cost increases if housing supply is not sufficient.

Social impacts on the Fort Berthold Reservation would occur with Level 1 and 2 development. Population increases associated with the proposed action would affect Fort Berthold culture, political behavior, and public safety. Housing shortages may occur, particularly in the community of Twin Buttes, due to population shifts between segments of the reservation by In-

dians seeking energy related employment. Twin Buttes also would be the reservation community to experience overcrowding of education facilities.

Impacts associated with Federal Coal Study Areas and Level 3 would be similar to Level 1 and 2; however, the magnitude would be greater if these impacts are accumulated with Level 1 and 2.

MITIGATING MEASURES

There are relatively few enforceable federal, state, or local mitigating measures available to reduce adverse social impacts caused by expanding energy development. The single most important form of mitigation would be a commitment, by the applicants, to hire as many local residents as possible. Local hiring would reduce population growth and consequent social impacts. A reduction in the number of in-migrating workers would accompany applicant compliance with the Equal Employment Opportunity program by insuring that women and minorities, including Indians, are given serious consideration for available jobs.

The North Dakota Public Service Commission or North Dakota Water Commission could phase the timing of Level 1 and tentative projects, mitigating impacts through reduction in area population growth.

Attraction of physicians and establishment of additional medical care facilities would reduce the adverse health care impacts.

Community programs, oriented toward strengthening the nuclear and extended family and toward involving newcomers in community affairs, would lessen mental health and family impacts, particularly during the construction phase.

The hiring of qualified law enforcement officers would help prevent and control criminal activity.

Consolidation of school districts and construction of new facilities would improve educational opportunities for both existing and new students.

Low income and company sponsored housing could be provided in communities with substantial population growth.

Desirable mitigation measures could be implemented through attachment of conditions to siting permits, water permits, and county zoning and use permits.

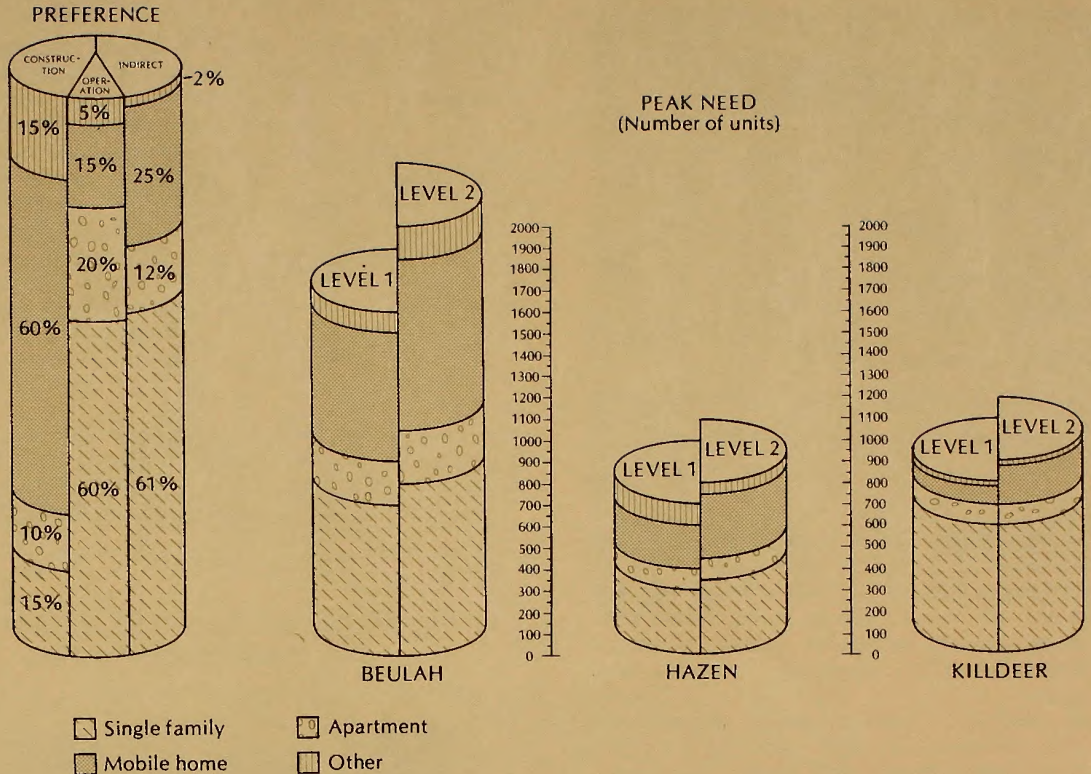


FIGURE 26: HOUSING PREFERENCE AND NEED

RESIDUAL IMPACTS

Social impacts generated by Level 1 and 2 development would be most evident in Dunn, McLean, and Mercer Counties. The increased population would generate mental health problems, shortages of health facilities and personnel, and a number of fatal and non-fatal industrial accidents.

The family structure would generally be weakened. The incidence of child abuse and neglect would probably increase. Social service organization caseloads would grow, necessitating additional personnel.

Crime rates would expand, and additional law enforcement officers would be required in Dunn, McLean, and Mercer Counties, especially during the construction

period.

New student enrollment, particularly in the communities of Beulah, Hazen, and Killdeer, would result in insufficient classroom space.

Shortages of housing units and increased housing costs, particularly in Dunn, McLean, and Mercer Counties during the Level 1 and 2 construction periods, could be expected. Persons on fixed incomes would probably experience problems with higher housing costs.

The unenforceable mitigating measures which depend on public sector investments would not significantly affect the level of change in these communities. Rapid population growth, particularly in Beulah, Hazen, and Killdeer, would still temporarily contribute to chaotic and uncertain social conditions.



Land Use

Land use addresses four interrelated subjects: land use, transportation, ownership, and planning and zoning.

The seven county study area encompasses 7,176,075 acres or 11,213 square miles. Land surface alone accounts for 6,865,291 acres, nearly 96% of the total area. Water surface, principally the Missouri River and Lakes Sakakawea and Audubon, comprises the remaining 310,748 acres. Cropland constitutes the major land use category with 3,547,707 acres, over half of the total land surface.

Major transportation systems include state and local highways, buslines, and railroad and airline networks.

The seven county study area is characterized by a fragmented pattern of federal, state, and private surface and subsurface holdings. Most of the surface is held in private ownership although lands, both federal and state, comprise 13% of the total. The federal government, the single largest owner of subsurface coal, holds 14% of the acreage. State coal ownership accounts for another 12% of the subsurface acreage. Burlington Northern, with 7% of the area subsurface, has the largest private sector coal holdings.

Planning and zoning provide locally exercised control over both specific project proposals and population related growth.

MAJOR IMPACTS

Projects in Level 1 would permanently convert about 6,948 acres of primarily agricultural land to urban and built-up uses (3,203 acres for facility siting and 3,745 for new urban population uses). Plant siting would

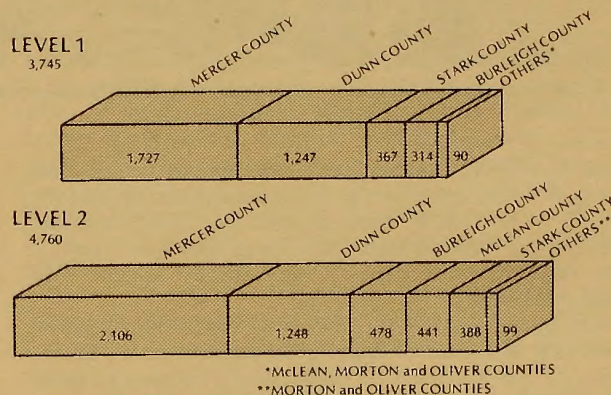


FIGURE 27: NEW URBAN ACREAGE — 1989

affect 575 acres of prime farmland and 169 acres of irrigated land. The tentative projects would permanently convert another 1,125 acres for facility siting and 1,015 acres for urban population uses. The distribution of land for new urban population use is shown in Figure 27. Total permanent land disturbance would result in an annual loss of agricultural products amounting to \$65,000 for Level 1 and \$95,000 for Level 2.

Figure 28 shows temporary mining disturbance acreage for Levels 1 and 2 by land use type. Disturbance during Level 1 would affect 34,217 acres. The tentative projects would add another 41,800 acres for a Level 2 total of 76,017 disturbed acres (65% cropland and 32% rangeland). Assuming each acre of cropland and

rangeland would be out of production a maximum of five years, the value of agricultural products lost would total \$3,737,000 for Level 1 and \$10,065,000 for Level 2.

Some of the disturbed acreage would be forest or wooded land, difficult to reclaim and irreplaceable in the short term (15 years).

Level 3 energy development would also result in permanent and temporary disturbance of land, with agricultural production losses greatest in McLean County due to high cropland percentages.

The value of agricultural production losses due to potential mining in Federal Coal Study Areas S-1, S-4A, S-4B, N-1A, and N-1B would be greater than in other areas due to their high cropland percentages. Mining in Federal Coal Study Areas could also result in the disturbance of 750 acres of irrigation-permitted land and a



Agriculture is the dominant land use.

long-term loss of up to 2,519 acres of forest or wooded land in Federal Coal Study Area S-3.

New highway traffic generated by Level 1 peak construction would heavily impact Interstate 94 and State Highways 8, 22, 49, and 200. An 800% increase in traffic volume would occur on State Highway 200 between Beulah and Hazen. Highway improvement needs by 1989, when all Level 1 and tentative projects are operational, would cost approximately \$79,246,000. This cost is \$53,293,000 more than would normally be spent on the same highways by 1990. Figure 29 portrays highway and street improvement costs.

Projects in Level 1 would require 13 miles of new rail-



A federally funded rural bus system serves the elderly and handicapped.

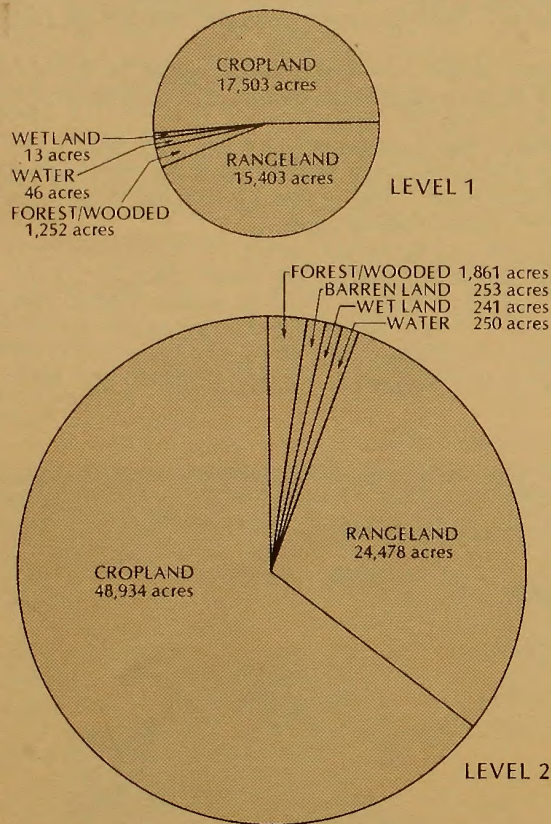


FIGURE 28: MINING DISTURBANCE OF LAND

road right-of-way and expand the number of rail cars using the Burlington Northern Mandan-Killdeer branch-line by 51%. The tentative projects would add another 16 miles of new railroad right-of-way and generate 9.2 new coal unit trains daily on the Soo and Mandan-Killdeer branchlines.

Approximately 454 miles of new electrical transmission lines and 2,426 miles of new pipeline would be required. Figures 30 and 31 depict new pipeline and electrical transmission line mileage for the seven county study area. Construction would temporarily disturb 5,283 acres, 3,572 in the seven county study area, including some wooded cover and portions of shelterbelts.

Further coal-related development in or near the Beulah-Center and North Beulah-Hazen Level 3 areas could add more electrical transmission lines or pipelines to a geographic area already containing a substantial concentration of transmission facilities. Hardwood draws, which are Public Service Commission transmission line siting avoidance areas, are most prevalent in the Dickinson-Dunn and Glen Ullin Level 3 areas. The amount of irrigated land, also an avoidance area, is greatest in North Beulah-Hazen and Garrison Level 3 areas.

The concentration of transmission lines in the Federal Coal Study Areas S-4A and S-4B could hinder coal extraction, possibly resulting in the relocation of some

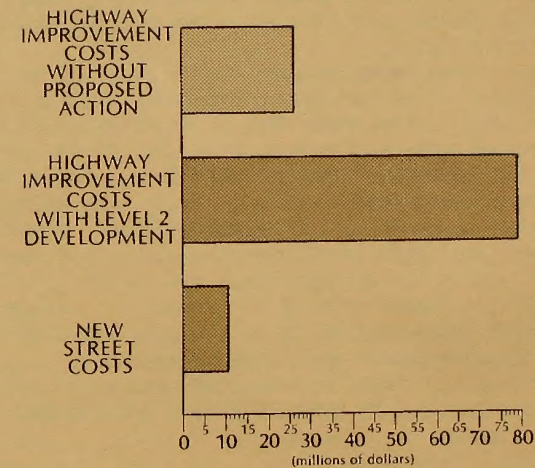


FIGURE 29: HIGHWAY AND STREET IMPROVEMENT COSTS

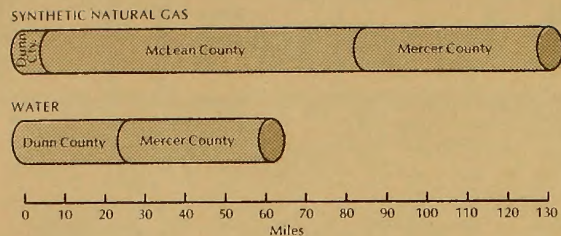


FIGURE 30: NEW PIPELINE MILEAGE IN THE SEVEN COUNTIES

of these lines.

Level 1 and tentative project mining could affect up to 3,120 acres of public surface, all of which is state owned and presently leased for agricultural use. Public ownership accounts for about 2% of the Level 3 sur-

face. Figure 32 shows subsurface ownership of active and tentative project mining areas. Public subsurface would account for 42% of the project mining areas in Level 1 and 24% of the project mining areas in Level 2. Subsurface ownership of Level 3 areas is 35% public.

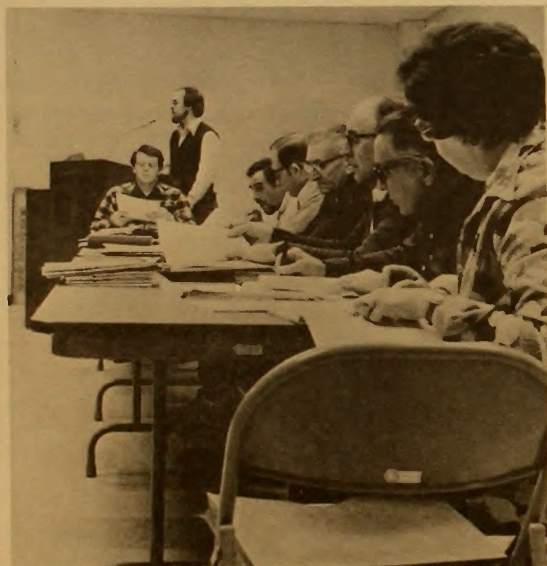
MITIGATING MEASURES

Mitigating and enhancing measures are similar for Levels 1, 2, and 3. Heavy reliance would be placed on federal and state reclamation law to insure that un-reclaimable land is not disturbed and that reclaimable land is restored to prior productivity. The exclusion of forest or wooded areas, usually hardwood draws, from mining would be enforceable under both federal and state law. The state energy conversion and transmission facilities siting law would protect culturally important or environmentally sensitive areas, particularly prime farmland and irrigated land, from project siting. Applicants must also adhere to state siting and county zoning permit conditions on such matters as road closures, highway maintenance, diminished or deteriorated water supplies, safety measures, soil erosion, or reclamation of plant sites.

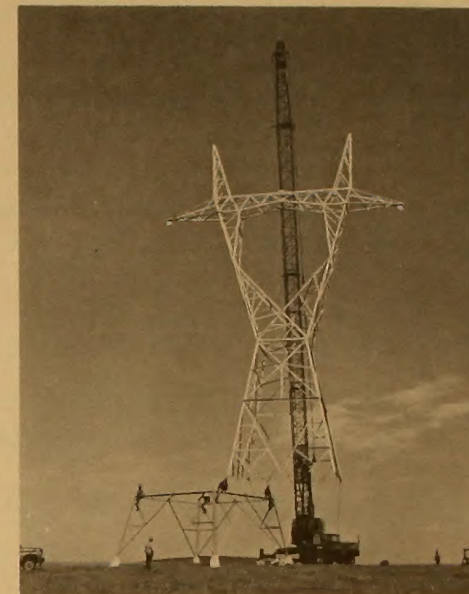
State subsurface leasing could be coordinated with federal leasing to discourage speculation and to allow for use of federally developed environmental planning data.

County and municipal zoning authority could play a significant role in promoting well-planned urban and built-up growth adjacent to existing cities and development.

The most important non-enforceable transportation mitigating measures would include: immediate commencement of needed highway improvements, with some completed prior to construction peaks; provision of adequate housing and trailer parking facilities near project sites to reduce commuting; and upgrading of the Mandan-Killdeer branchline to permit greater movement of construction materials by rail.



A meeting of the Mercer County Planning and Zoning Commission.



Transmission line concentrations would increase.



Reclamation of new pipeline rights-of-way would be required.

RESIDUAL IMPACTS

The proposed projects would permanently remove agricultural land from production for facility siting and urban and built-up uses resulting in a loss of agricultural products valued at \$95,000 annually.

Approximately 76,017 acres would be temporarily disturbed by mining operations in Level 2, 34,217 by projects in Level 1 and 41,800 by tentative projects. Agricultural production losses for Levels 1 and 2 would amount to \$3,737,000 and \$10,065,000 respectively. The cost of producing post-mining yields comparable to those produced before mining may be higher due to greater water, fertilizer, or labor inputs.

Highway improvements would cost \$79,246,000, surpassing normal programmed costs for the same highways and same time period by \$53,293,000.

The 29 miles of new railroad right-of-way, the 51% increase in rail cars movement, and the 9.2 new unit trains daily would add to the potential for accidents, lengthen traffic waiting times, and increase air emissions and noise levels.

Construction of new electrical transmission lines and pipelines would temporarily disturb 5,283 acres, 3,572 in the seven county study area, including some wooded cover and portions of shelterbelts.

Planning and zoning administrative burdens could lead to establishment of new planning positions by local units of government and a need for supportive funding.



New highway construction and maintenance needs would burden existing facilities.

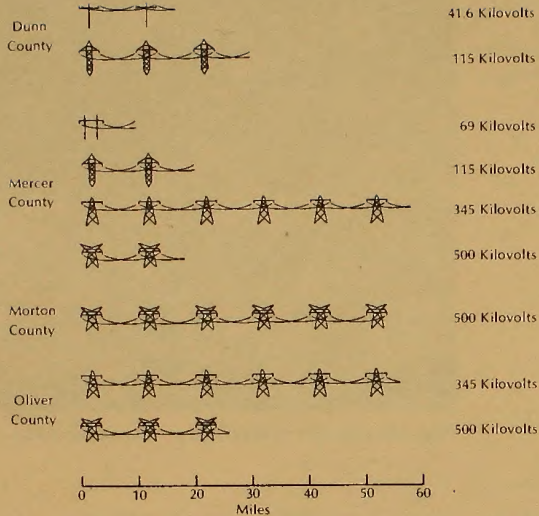


FIGURE 31: NEW ELECTRICAL TRANSMISSION MILEAGE IN THE SEVEN COUNTIES



More rail and highway traffic conflict could be expected.

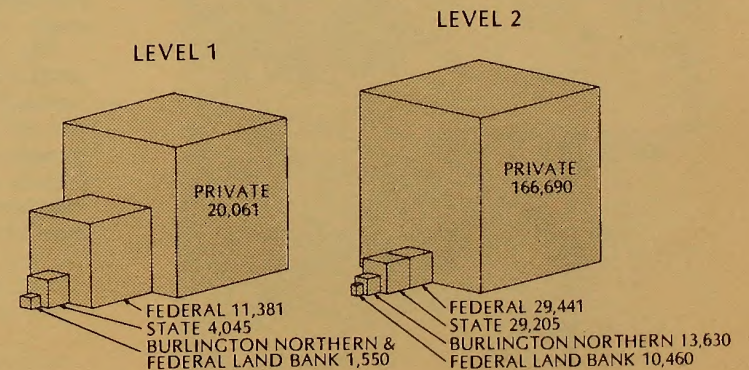


FIGURE 32: SUBSURFACE OWNERSHIP ACREAGE

Federal Coal Considerations

A major basis for future federal coal development decision in North Dakota is the Bureau of Land Management's "Land Use Analysis" resource planning process. Through this process 12 Federal Coal Study Areas were established. They will be reevaluated as a result of this study and the nationwide programmatic EIS now underway before any coal development proposals are made. While these Federal Coal Study Areas may have some relationship to the Level 1 and tentative projects, the competitive leasing process offers no assurance that these particular projects would obtain federal leases, or even that federal lease proposals would be forthcoming from the revised leasing program. The Department of the Interior is presently enjoined from further leasing of federal coal unless it meets specific short-term demand criteria.

Federal coal by itself could not support even a small mining operation. Because of the average low federal strippable coal acreage (22%) and its random distribution, most of the projects in the proposed action are capable of operation regardless of whether the federal government leases additional coal. Exceptions include the Natural Gas Pipeline Company proposal, which would require federal coal leases for about 37% of the project's mine area, and the Glenharold Mine, which would expect problems in maintaining full production without further federal leasing. Although other companies have indicated they have sufficient reserves and could continue to economically mine those reserves, federal coal would increase mine efficiencies and reduce the potential loss of coal resources.

The Federal Coal Study Areas contain about 2,000 acres of prime farmland. Wind and water erosion susceptibility is high in several of the areas. Also, some of the areas have sodium affected soils and lack the necessary 30 inches of plant growth material.

Mining disturbance of large amounts of shrubland, woodland, and wetland habitat in some of the Federal Coal Study Areas would significantly affect white-tailed deer, pheasant, furbearer, and waterfowl populations.

Outdoor recreation would be affected by mining in Federal Coal Study Areas located near the Missouri River breaks and the southern shore of Lake Sakakawea.

Social and economic impacts would be very similar to

impacts previously associated with Level 1 and 2 development.

Mining would cause a substantial loss of agricultural production in areas with high cropland percentages and could disturb about 750 acres of irrigation-permitted land.

Federal Coal Study Areas S-3, S-4A, S-4B, and N-1A are generally shown to be the most environmentally sensitive to mining.



Mining of federal coal would affect waterfowl production areas.



Federal coal would be essential for the Glenharold and AMAX Mine operations.

Alternatives

Developing and examining alternatives to the proposed and possible future actions provides decision-makers with opportunities to weigh various courses of action prior to approvals, disapprovals, or approvals with modifications.

The proposed action includes five coal conversion facilities and nine mines. All of these are subject to a diverse group of federal, state, and local authorities; therefore, the number of variables which could affect the magnitude and distribution of the energy development is extremely large. Because of the complexity of the proposed action, emphasis is placed on the broad alternative concepts rather than detailed modifications or alterations.

NO FURTHER DEVELOPMENT

The no further energy development alternative is based on the assumption that regulatory agencies would either disapprove or refuse to act on individual proposals, thereby limiting energy conversion facilities and mines to those now in operation or under construction. Thus, the environment would change only as indicated by present trends.

This alternative would eliminate all of the adverse environmental impacts expected to accompany the proposed action. However, in the absence of the proposed energy development, potential state and local coal severance and conversion tax revenues would be lost. Many of the counties and communities in the seven county study area would continue to experience employment and population declines. Halting energy development could also lead to production and employment

losses where adequate energy supplies are lacking.

NO LEASING OF FEDERAL COAL

Cessation of federal leasing would prevent the mining of federal coal, thus constraining any mining operations heavily dependent on federal coal. Both the AMAX and Glenharold Mines need substantial amounts of federal coal in order to commence or continue mining operations.



Solar collectors.

Since the NGPL Coal Gasification project is dependent on federal coal, a no-lease policy would eventually halt its progress and eliminate the associated impacts. The Glenharold Mine would experience difficulties in maintaining current production levels. The remaining projects would still disturb land, affect various aspects of the physical environment, and generate economic and social change.

Without federal coal leasing, the checkerboard pattern of federal coal ownership would contribute to greater disturbance of private land and inefficient use of the coal resource. Mining operations would mine around federal coal, thereby requiring more boxcuts and additional land for overburden storage. Some undisturbed surface would be inaccessible due to the mining pattern, thereby limiting grazing and wildlife habitat use during mining operations.

The bypassed federal coal resources would probably be lost since future mining would most likely be uneconomical. In addition, state and local governments would lose coal severance and conversion tax revenues as well as federal coal royalty payments.

ALTERATION OF SCHEDULES

Altering the construction or operating schedules of one or more of the 11 projects included in the proposed action could significantly change impacts. Such phasing would stagger start-up dates while still maintaining proposed energy development levels.

While this alternative would lessen some of the physical environment impacts, its major effect would be on people and their activities. Phasing of the schedules

would result in significant reductions in the rate of population influx, thereby decreasing those impacts directly tied to rapid population growth.

Phased construction or operation would result in delayed coal severance and conversion tax revenues and deferred deliveries of energy to consuming areas.

PROJECT MODIFICATION

The project modification alternative would change impacts through modification of project location or design. The timing and levels of development presented in the proposed action would still be maintained.

Relocation of various projects would lessen some environmental impacts by reducing the concentration of facilities in a limited geographic area. However, relocation effects on some environmental components could either be similar, regardless of location, or difficult to predict.

Design modifications could have desirable effects by reducing some adverse impacts. Suggested modifications include different mining plans, alternate waste disposal systems, changes in coal conversion facilities design, and modification of project pollution control systems.

COAL EXPORT

A large amount of mine-mouth conversion energy now produced in the seven county study area is exported for use outside North Dakota. However, recent regulatory and technical developments, and landowner opposition to transmission facilities, may now render siting in consuming areas more desirable or necessary.

Coal export would still permit new growth and contribute to reversal of net out-migration and economic trends in North Dakota, but in a manner much less disruptive to rural communities. Those impacts associated with population and air quality would also be diminished.

Adverse impacts associated with increased coal export by rail would include greater diesel fuel consumption, exhaust emissions, noise, and car-train accidents. These impacts would depend upon the number



Increased coal export would reduce the number of mine-mouth conversion facilities.

of train movements and the haul distance. Coal slurry pipelines would require large quantities of water and would compete with agricultural and domestic needs for future allocations. State and local coal conversion tax revenues would decrease with fewer mine-mouth conversion facilities.

ALTERNATE ENERGY SOURCES

In order to maintain continued economic growth, the nation must limit its reliance on conventional oil, gas, nuclear fission, and hydroelectric generation energy sources. The use of oil and gas is highly desirable from an environmental standpoint but undesirable due to resource conservation, economic, and political reasons.

Nuclear power is cleaner than coal in terms of contaminant emissions, wastes generated, and health and safety considerations per unit of output. However, there are serious reservations concerning the acceptable degree of risk associated with malfunctions or accidents. Also, timely development of nuclear facilities is difficult due to the current regulatory and procedural problems.

Less traditional energy sources should account for an increasingly larger portion of the nation's energy production. Solar electric, tar sands (petroleum source), wind fusion, municipal solid waste, and biomass (organic material) sources are expected to eventually contribute to the energy supply, but not until present economic barriers and technical limitations have been surmounted.

CONSERVATION

Gross energy consumption in the United States during the last quarter century has more than doubled with an average annual growth rate exceeding 3%. Forecasts suggest that, if left unconstrained, energy consumption will increase by 31% to 48% by 1985. The Federal Energy Administration has estimated that by 1985 higher energy costs could reduce the average annual growth rate to 2.8%. An active conservation program could further reduce the growth rate to 2.2%. These reductions would be more than enough to offset the energy to be produced by the proposed action. In fact, conservation efforts would need to be only 5.5% to 8% effective in order to equal the proposed energy production.

Energy conservation efforts generally attempt to diminish per capita consumption. Lower consumption levels can be reached with increased energy efficiency and reduced demand, although the various methods are often viewed as physically inconvenient and costly. In order to prevent any unacceptable disruptions, change must allow for orderly social and economic adjustment.

North Dakota is committed to a policy of comprehensive energy conservation. The state energy conservation plan has set a goal of 6.3% reduction in energy consumption by 1980. A similar goal is envisioned in the National Energy Plan, which calls for 3.9% to 6.4% reduction in consumption by 1985.

Participation and Consultation

The West-Central North Dakota Regional Environmental Impact Study is a cooperative federal and state effort involving a wide variety of agencies at both levels of government. In addition to major participation by some agencies, many others helped coordinate various parts of the analysis and provided valuable assistance in preparing and reviewing materials.

Coal and energy industry representatives were notified of plans for a regional environmental impact statement at a June 1976 meeting in Bismarck, at which time industry project proposals were solicited. After letters of intent were received, contact with individual industry representatives was established in order to assemble information for each project proposal.

Public participation was invited early in June to insure that the impact study would address public concerns and be of use to the public and decisionmakers. Seven meetings were held in Beulah, Dickinson, Glen Ullin, Killdeer, Mandan, Twin Buttes, and Underwood. In addition to many personal contacts, news releases, paid newspaper ads, and television coverage, letters were sent to the state's congressional delegation, mayors, county and city commissions, tribal councils, interest groups, universities, research institutions, government agencies, and industry. The public meetings resulted in comments and questionnaires which were later published in a "Public Concerns" booklet. This booklet was widely distributed throughout North Dakota and the major public concerns have since been addressed in the study.

Public information programs are planned after completion of the study.

MAJOR PARTICIPATING AGENCIES

FEDERAL

Agricultural Research Service
Bureau of Land Management
Bureau of Mines
Bureau of Reclamation
Energy Research and Development Administration
Fish and Wildlife Service
Geological Survey
Old West Regional Commission
Rural Electrification Administration
Soil Conservation Service

STATE

Agriculture Department
Game and Fish Department
Governor's Office
Health Department
Highway Department
Indian Affairs Commission
Natural Resources Council
Parks and Recreation Department
Planning Division
Tax Department
Water Commission

ADDITIONAL PARTICIPATING AGENCIES

FEDERAL

Bureau of Indian Affairs
Bureau of Outdoor Recreation
Corps of Engineers
Environmental Protection Agency
Forest Service
Highway Administration
Missouri River Basin Commission
National Park Service

STATE AND LOCAL

Attorney General
Business and Industrial Development Department
Coal Impact Office
Comprehensive Employment and Training Act
Administration
Employment Security Bureau
Energy Management and Conservation Office
Forest Service
Geological Survey
Historical Society
Land Department
League of Cities
North Dakota State University
Public Service Commission
Regional Environmental Assessment Program
Regional Planning Councils
Social Service Board
Soil Conservation Committee
University of North Dakota
Veterinarian's Office
Vocational Education Department



Mapping involved extensive agency coordination.



Meeting of the staff located in Bismarck.

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Clark Equipment Company

Fish and Wildlife Service

Hazen Star

Natural Gas Pipeline Company of America

North Dakota Game and Fish Department

North Dakota Health Department

North Dakota Highway Department

North Dakota Historical Society

North Dakota Parks and Recreation Department

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